Committee 15

Surgery for Pelvic Organ Prolapse

Chairman

L. Brubaker (USA)

Members

C. Glazener (U.K),

B. Jacquetin (France),

C. Maher (Australia),

A. Melgrem (USA),

P. Norton (USA),

N. Rajamaheswari (India),

P. Von theobald (France)

CONTENTS

Surgery for Pelvic Organ Prolapse

L. Brubaker,

C. Glazener, B. Jacquetin, C. Maher, A. Melgrem, P. Norton, N. Rajamaheswari, P. Von theobald

INTRODUCTION

Surgery for pelvic organ prolapse (POP) is common with increasing high-quality evidence to guide surgical practice. Yet many important basic questions remain, including the optimal timing for POP surgery, the optimal pre-operative evaluation of urinary tract function and the post-operative outcome assessment. Olsen [1] and Fialkow [2] have separately documented high rates of surgery for POP and/or urinary incontinence (UI) in US women. In Fiakow's study, 169 women who underwent a primary prolapse surgery (± concomitant UI procedure) were identified (**Table 1**).

In addition, there remains uncertainty about the longevity of prolapse repairs, with some experts stating that recurrences may be inevitable in at least a subgroup of women. Olsens' recurrence rate estimate was based on 384 women in the Kasier Permanente Northwest population who underwent at least one POP/UI procedure. In that study, only 13 sacro-colpopexies were performed, reflecting the surgical practice in 1995. Until women at higher risk for recurrence are reliably identified prior to surgery, re-operation rates of up to 30% may persist.

Despite the need for additional studies to guide many aspects of POP surgical care, this chapter can be used to facilitate evidence-based management of POP. This committee has deliberated, graded evidence and provided recommended areas of high priority for current surgical care as well as further POP research. Readers of this chapter are also encouraged to periodically review continuously updated evidence from reviews including the Cochrane and NICE reports [3, 4]. This chapter also includes scientific contributions with lower levels of evidence than these reviews so that we can highlight the areas for future research.

I. OUTCOME ASSESSMENT

One of the most glaring limitations in recommending evidence-based POP surgery is the lack of an optimal method for determining outcome. While anatomic correction is usually reported, there is good evidence that POP and POP repairs have significant impact on urinary, sexual, and anorectal function; these aspects should be taken into account when assessing the outcome of POP surgeries. Therefore, recognizing that pelvic organ prolapse is a multidimensional disorder, outcomes of treatments should be evaluated in multiple domains. Group consensus statements

Table 1. Age-specific incidence of surgically-managed POP and UI (per 1,000 women years)

Age group (yrs)	At risk women	POP only	UI only	POP and UI	All cases
20-29	23,560	0.17	0.00	0.04	0.21
30-39	34,893	0.31	0.34	0.11	0.77
40-49	36,120	0.72	0.72	0.30	1.74
50-59	18,976	0.94	1.05	0.47	2.48
60-69	15,368	2.10	0.78	0.26	3.12
70-79	12,958	2.54	0.85	0.31	3.70
80+	5,844	1.71	0.17	0.34	2.22
Total	147,719	0.91	0.56	0.24	1.70

Adapted from Fialkow et al. Int Urogynecol J (2008) 19:437-440 (2)

agree with this philosophy, although there is no evidence-based recommendation for optimal outcome assessment at this time [5]. In addition, it is imperative that future research address the patient's global perspective as an outcome in order to understand the contributions of various anatomical and functional sub-outcomes on the overall patient experience.

1. OUTCOME ASSESSMENT: ANATOMY

There is no consensus on several critical areas of outcomes. There are significant difficulties in creating dichotomous anatomical outcome criteria for success and failure, especially in the absence of symptoms. This difficulty is exacerbated in the situation where support loss is evident in an unoperated portion of the vagina and there is no consensus regarding coding of "de novo" POP. Finally, it is likely incorrect to strive for "perfect" support of the vagina (Stage 0) as this is inconsistent with the demographic profile of asymptomatic vaginally parous women [6].

In addition, the five-level staging system of the current POP-Q (Stages 0-IV) may be insufficient to discriminate among clinically important groups of women with POP, placing virtually all such women into Stage II or III. While the staging may facilitate comparisons, it may not describe sufficient detail as the individual POP-Q measurements provide. While most surgeons believe that prolapse beyond the hymen following POP surgery is not an optimal anatomic outcome, the required level of support above the hymen is not known and the relationship with symptoms remains poorly understood.

2. OUTCOME ASSESSMENT: SYMPTOMS

It is well recognized that symptoms and anatomy do not necessarily correlate in women with pelvic organ prolapse. Burrows et al reported that while women with more advanced prolapse are less likely to experience stress urinary incontinence, bothersome sexual or ano-rectal symptoms do not correlate with prolapse severity [7]. The symptom of feeling or seeing a bulge is reliably associated with the anatomic finding of prolapse [8]. However, other symptoms may impact the perception or bother of the anatomic finding. FitzGerald et al reported that women planning sacrocolpexy with Stage II POP and prior pelvic surgery reported more symptoms and quality of life impact than those with more advance prolapse [9]. Symptoms of urinary incontinence, fecael incontinence, sexual dysfunction, voiding dysfunction and defecatory dysfunction are common in women with prolapse, but are not well correlated with anatomic findings [10]. Nonetheless, most patients expect resolution of pelvic symptoms following surgery.

a) Urinary Symptoms

Urinary Incontinence: There is a risk of *de novo* stress incontinence following POP repair by any route. This risk is approximately 44% following sacrocolpopexy in stress continent women [11] and can be reduced by concomitant Burch colposuspension. It is not known if other continence procedures are protective in this surgical setting. Estimates for de novo stress incontinence following vaginal repair range between 15 to 80% [12]. An ongoing trial (Clinicaltrials.gov NCT 00460434) is assessing the utility of concomitant TVT at the time of vaginal prolapse repair in stress continent women. The risk of urge incontinence is also present, although there is growing evidence that prolapse repair improves this risk [13, 14]. Improvement of urge incontinence may be a welcome side effect of the surgery, but it is not an indication for surgery per se.

Voiding dysfunction: Voiding function is expected to improve after surgical correction of prolapse. Fitzgerald and co-workers found significant improvement in bladder emptying in patients after surgery for advanced POP [15]. Before surgery, the average post-void residual in 35 patients was 226 mL, and this was reduced to less than 100 mL in 89% of the women after surgery for POP.

b) Sexual function

The effect of POP on sexual function is variable, but repair of POP may improve sexual function. In the Colpopexy and Urinary Reduction Efforts (CARE) trial, more women were sexually active one year after abdominal sacrocolpopexy (171, 76.3%) compared to before surgery (148, 66.1%), and significantly fewer women reported sexual interference from pelvic and vaginal symptoms [16]. Pauls and colleagues [17]reported no change in sexual function and sexual frequency using the Female Sexual Function Index (FISI) and other standardized questionnaires in prospectively surveyed women undergoing POP surgery with and without continence procedures. In those women, the most bothersome barrier to sexual activity before repair was vaginal bulging; postoperatively, it was vaginal pain. De novo dyspareunia is a risk of many transvaginal prolapse repairs.

c) Ano-Rectal Symptoms

Ano-rectal symptoms are common in women with POP [18]. Fifteen to 20% of women with POP or SUI also report fecal incontinence [19]. Meschia evaluated 881 women with UI or POP, of whom 178 also had anal incontinence. Two-thirds reported constipation, with other common complaints of incomplete evacuation, and splinting in the vaginal or perineal body to effect evacuation [20].

Although such symptoms are common, they do not correlate well with prolapse stage. Bradley et al [18] described the prevalence of pre-operative bowel symptoms and Colorectal-Anal Distress Inventory symptom scores in 322 women planning sacrocolpopexy. Correlations between symptoms and

prolapse were negative and weak, indicating that bowel symptoms do not increase with increasing prolapse stage [18].

Although there is no level 1 evidence regarding the impact of POP surgery on these symptoms, ano-rectal symptoms were assessed in the CARE trial. Surgeons were allowed to include posterior colporrhaphy (in addition to sacrocolpopexy) at their discretion. The sacrocolpopexy with posterior colporrhaphy group (n= 87) had more baseline obstructive colorectal symptoms (higher Colo-Rectal-And Distress Inventory(CRADI) and CRADI-obstructive scores: P =.04 and .01, respectively) than the sacrocolpopexy alone group (n =211). However CRADI total, obstructive, and pain/irritation scores significantly improved in both groups (all P =.01) [21].

3. OUTCOME EVALUATION: QUALITY OF LIFE

It is recommended that investigators describe the impact of POP surgical treatment on quality of life. Maher et al reported significant improvements in condition-specific and generic QOL after SSLF, similar to that after abdominal sacrocolpopexy [22]. The CARE trial also reported significant improvements in quality of life following sacrocolpopexy at three months and two years [11, 14]. In that trial, Nygaard et al reported pre-surgical physical activity levels [23]. Most participants were physically active preoperatively, but reported that prolapse substantially interfered with exercise or recreation (27%), household work or yard work (19%) and work outside the home (8%) The interference was not associated with the stage of prolapse.

In the first study of its kind, Jelovsek et al assessed body image using a modified body image scale [10]. These investigators reported that women seeking treatment for advanced pelvic organ prolapse had measurable decreases in body image and overall quality of life. The idea that distortion of body image is a factor that impacts quality of life is novel and a fruitful area for further research.

II. SELECTION OF SURGICAL ROUTE FOR RECONSTRUCTIVE POP PROCEDURES

The individual woman's surgical history and goals, as well as her individual risks for surgical complications, prolapse recurrence and de novo symptoms impact surgical planning. In addition, the route and method of access for reconstruction may include laparoscopic and robotic techniques. In the U.S., 80-90% of prolapse surgeries are completed vaginally [24].

1. COMPARISON OF OPEN ABDOMINAL TO VAGINAL

Level one evidence supports a higher anatomic efficacy with abdominal route of surgery. There are three randomized controlled trials designed with the specific aim to compare vaginal and abdominal routes for the surgical correction of POP [22, 25-27] as well as a Cohrane review [27] and the major outcomes are summarized in Table 14. Although these studies had relatively small numbers for comparison (approximately 40 women in each comparison group), the effect sizes were large.

In the first trial designed to compare route of POP repair, Benson et al reported that the abdominal route had better anatomic results 1 to 5.5 years (mean 2.5 years) after surgery compared with the vaginal route, OR for optimal cure (no symptoms of POP, no anatomic defect beyond the hymeneal ring) 3.44, 985%CI 1.24-9.69). The Benson study was stopped when the planned interim analysis revealed the superiority of the abdominal approach. Of the 101 women randomized, ten decided against surgery after randomization, 3 refused their abdominal route randomization assignment, and 8 were not available for long term evaluation, leaving a sample size of 80 women. A significant proportion of participants who were randomized to the abdominal group also had vaginal procedures performed (30% anterior colporrhaphy and 50% posterior colporrhaphy.) Needle urethropexy, a widely used procedure at the time of the trial that has since been abandoned, was used as the primary incontinence procedure in the vaginal repairs. Since that time, the combination of needle urethropexy and sacrospinous ligament suspension has been abandoned because it predisposes to upper vaginal wall prolapse [28]. Given that this was the first such trial, the optimal vaginal approach was not known.

Experts have expressed concern that the specific primary prolapse procedures performed may have been responsible for differences in outcome rather than the surgical route: these include (vaginal route) bilateral sacrospinous suspension, vaginal paravaginal repair, Pereyra needle urethropexy; and (abdominal route) sacrocolpopexy, retropubic paravaginal repair, and Burch colposuspension. In addition, the results for women with concomitant hysterectomy were not reported separately. The abdominal route was associated with higher costs, longer operating times, and increased complications, although the numbers did not reach statistical significance due ot small numbers. Of note is that post-operative dyspareunia was seen only in the vaginal group (15/26, 58%).

Lo and Wang (1998) randomized 138 women with Stage III-IV uterine prolapse or vaginal vault prolapse; 20 were excluded after randomization for inability to follow-up. Of the remaining 118, 52 underwent sacrocolpopexy with mersilene mesh and 66 underwent sacrospinous ligament fixation with polypropylene suture. The definition of cure was POP no greater than Stage II (no greater than 1 cm beyond the hymeneal ring), and at a median of 2.1 years after

the index surgery, 49/52 (94%) of women undergoing SC were cured, while 53/66 (80%) of women undergoing SSLF met the definition of cure. Complications were higher in the vaginal group with increased blood loss and longer hospital stays, with some serious complications of rectovaginal fistula and ureteric injury. While there are several methodologic problems with this RCT, there was a higher rate of dyspareunia due to vaginal narrowing in the SSLF group (7/66, 39%, 4 of whom were sexually inactive due to the complication) compared to the SC group (1/52, 9%.)

Maher and colleagues (2004) performed an RCT randomizing 95 women to sacrocolpopexy (n=47) and sacrospinous ligament fixation (n=48) with follow up at two years (6-60 months). This study differs from that of Benson in that all subjects had already undergone hysterectomy, no patients in the vaginal group had either a needle urethropexy or vaginal paravaginal repair, and the minimum allowed duration of follow-up was six months (mean 22-24 months) rather than Benson's 12 months (mean 30 months.) Although this group reported comparable subjective and objective outcomes between the two surgical groups, a subanalysis showed anatomic superiority of the abdominal group (OR18, 95% CI .05, .55) with a significantly higher rate of combined recurrent anterior and apical prolapse. However, the abdominal route had longer operating times, longer hospitalization, more complications, and higher medical costs compared with the vaginal route.

The Cochrane review on the surgical management of prolapse by Maher et al summarizes these studies and concludes that these trials provide level 1 evidence that the overall outcome (including quality of life) is similar between abdominal and vaginal approaches, but that sacrospinous-based vaginal procedures have a higher anterior and apical anatomical recurrence rate and higher rates of dyspareunia than sacrocolpopexy-based abdominal repairs. This is somewhat offset by the higher short term morbidity of open abdominal sacrocolpopexy [22].

2. SAFETY ISSUES RELATED TO THE CHOICE OF SURGICAL ROUTE

In these trials, serious perioperative injuries are more common with abdominal than vaginal surgery. While it is known that the number of complications increases as the number of procedures increases, the number of procedures is less related to the route of surgery and more to the severity and number of pelvic floor defects requiring surgical correction. Safety associated with mesh will be considered separately later in the chapter.

Boyles [24] found that pre-existing comorbidities did not increase the risk of complications in a review of discharge diagnoses after surgery for POP, but this finding seems counter-intuitive and points out the limitation of this kind of review: it is unknown how the route of surgery nor preventative measures in individual cases affects these findings, and a prospective comparison is needed. Boyles examined mortality risk in some detail. Although the mortality rate was low (.53 per 1000 women), women who died were significantly older than those who survived (69.1 versus 52.1). Details on the route of surgery were often incomplete. In summary, what little is known about safety agrees with the commonly held opinion that vaginal surgery for POP is safer than abdominal surgery, and this may be an important consideration when deciding on the route of surgery for individual patients.

3. LAPAROSCOPIC AND ROBOTIC SURGERY

There are multiple reports of the feasibility of various abdominal prolapse repairs being performed using laparoscopic (with or without robotic assistance) surgical techniques, most reporting good short- and intermediate-term results. As of March 2008, no randomized controlled trials have been reported comparing laparoscopic to conventional abdominal POP procedures. There is no reason to believe that the same procedure performed in precisely the same manner using the same materials would have any different outcome using the laparoscopic abdominal technique compared to the open abdominal technique. However, there is likely to be different adverse events depending on the technique of access. In addition, procedures are sometimes modified to allow them to be performed more easily with laparoscopy, and so it is essential to establish independently the effectiveness and safey of the modified procedures in a well-designed RCT. Similarly the learning curves and number of procedures together with the frequency of performing these technically challenging operations have yet to be established for prolapse surgery by all routes and techniques.

III. EFFICACY OF SPECIFIC PROCEDURES

There are a variety of procedures suitable for surgical correction of prolapse. **Table 2** briefly summarized the main concepts of the broad surgical categories.

1. RECONSTRUCTIVE PROCEDURES

a) Apical support procedures

The apex is the keystone of pelvic organ support. Support of the apex must be assessed regardless of the presence or absence of the uterus. Without good suspension of the uterus or post-hysterectomy vaginal cuff, the anterior and posterior walls are exposed to intra-abdominal forces that drive these tissues toward the introitus. Because of the significant contribution of the apex to anterior vaginal support, the best surgical

Table 2. RCTs comparing abdominal versus vaginal approaches to POP surgery

	n	Mean f/umos)	Outcomes abd v vaginal	Major complications	Reoperation rate abd v vag
Benson 1996 [25]	80*	29 mos (12-78 mos)	Optimal [a] 22/38 (58%) v 12/42 (29%)	Dyspareunia 0/15 v 15/26 (58%)	6/38(16%) v 14/42 (33%)
Lo 1998 [26]	118**	25 mos (12-74 mos)	49/52 (94%) v 53/66 (80%)	Dyspareunia 1/52 (9%) v 7/66 (39%)	Not stated
Maher 2004 [22]	95	24 (6-60 mos)	Subjective [b] 43/46 (94%) v 39/43 (91%) Objective [c] 35/46 (76%) v 29/42 (69%)	Dyspareunia 1/52 (9%) v 7/66 (58%), UI 23% v 44%	6/47(13%) v 7/43 (16%)

*recruitment halted after first interim analysis showed superiority of abdominal route.
**138 randomized, but 20 excluded after randomization for inability to follow-up.
aoptimal cure defined as no prolpase symptoms, no anatomic defect beyond the hymeneal ring
bsubjective cure defined as no symptoms of POP
csubjective cure defined as no symptoms of POP , anatomic defect less than Baden-Walker grade 2 (prolapse to the hymeneal ring.)

correction of the anterior and posterior walls may fail unless the apex is adequately supported [30, 31]. While **recognition** of apical defects is one of the biggest problems in the evaluation of pelvic support defects, surgical **correction** of the apex has several good options with relatively high success rates.

1. Sacrocolpopexy

Sacrocolpopexy has proven to be a durable technique for apical support with an acceptable risk/benefit ratio (**Tables 3 and 4**). While level 1 evidence supports the usefulness of this procedure in POP, investigators are just beginning to test the hypothesis that will refine this technique, optimize concomitant procedures and urinary tract function. Because concomitant hysterectomy increases the risk of mesh erosion [32], alternative techniques including sacrohysteropexy or supracervical hysterectomy are being used based on clinical judgment.

Sacrocolpopexy requires an intervening material, typically a synthetic mesh. Level 1 evidence supports the superiority of polypropylene mesh to fascia lata for objective anatomic support following sacrocolpopexy [97]. There is no evidence for the equivalence or superiority of any material other than permanent synthetic mesh for this procedure. Expert opinion strongly warns against simple suturing of the apical skin as this is insufficient fixation and likely to result in recurrent prolapse.

Mesh erosion is a known complication of sacrocolpopexy regardless of performance of concomitant hysterectomy. A recent review [33] noted the rates of erosion to be 2-11% from institution to institution. Visco and colleagues [98]reported on 155 women and found an erosion rate of 3.2% with abdominal sacrocolpopexy, 4.5% when combined with colpoperineopexy, 20% when a combined abdominal/vaginal approach was used (sutures passed vaginally to abdominally) and 40% when mesh was introduced vaginally. Cundiff et al presented suture/mesh complications from the CARE trial (32) The predominant graft used was synthetic mesh; Mersilene (42%) or Polypropylene (48%). Twenty subjects (6%) experienced mesh/suture erosion. Unadjusted risk factors for mesh/suture erosion were expanded polytrafluroethylene (ePTFE) mesh (ePTFE 4/21 (19%) versus non-ePFTE 16/301 (5%): OR 4.2), concurrent hysterectomy (OR 4.9) and current smoking (OR 5.2). Of those with mesh erosion, most affected women (13/17) underwent at least one surgery for partial or total mesh removal. Two were completely resolved, 6 had persistent problems and 5 were lost to follow-up. No resolution was documented in the 4 women who elected observation. These investigators concluded that expanded PTFE mesh should not be used for sacrocolpopexy and documented that concurrent hysterectomy and smoking are modifiable risks for mesh/suture erosion. These data is corroborated by the majority of other evidence from Level 3 reports [84, 99, 100], although there is conflicting level 2 data from [91]. While uterine preservation (or supracervical hysterectomy) is an alternative, the utility and safety of these techniques are not known. In a level 2 RCT, Roovers et al reported poor outcomes for sacral hysteropexy as compared to vaginal repair [90].

Allograft fascia lata has been described variably as an alternative to mesh: the biologic graft avoids the risk of mesh erosion, but resulted in unexpected failures in which no mesh could be seen during reoperation [101-104].

Similarly, Flynn et al [105] reported on 24 colpopexies using allograft fascia lata in a retrospective design, and found unacceptable rates of anatomic improvement at one year follow-up.

Table 3. Table of Main Categories of Operations:

Operation	Description
FOR APICAL SUPPORT (UTERINE OR VAULT PROLAPSE)	
Sacrocolpopexy	Fixation of vagina through suspension material (preferably anterior and posterior vaginal arms of synthetic mesh to bridge to the anterior longitudinal ligament of sacrum.
Sacrocolpoperineopexy	Same technique as above, except that the posterior arm of mesh extends to t he perineal body.
Iliococcygeus fascia fixation	An extraperitoneal vaginal procedure that attaches the vaginal apex to the fascial coverings of the iliococcygeus muscles bilaterally, often with a suture-passing device.
Levator myorrhaphy with apical plication	Wide midline plication of the levator with fixation of the vaginal cuff.
Mayo culdoplasty	A modification of the McCall's culdoplasty attaches the apex to plicated uterosacral ligaments.
Sacrospinous ligament suspension procedures	This procedure suspends the vaginal apex to the sacrospinous ligament either unilaterally or bilaterally, typically using an extraperitoneal approach. The enterocele, anterior and posterior walls are repaired as needed.
	Traditional version: attaches one edge of the apex to the ligament using permanent suture
	Michigan modification [29] avoids a suture bridge and draws the entire vaginal apex into direct contact with the coccygeus muscle and underlying ligament, using delayed absorbable sutures across the entire vaginal cuff.
Uterosacral ligament suspension	This intraperitoneal vaginal procedure traditionally uses permanent suture to suspend the vaginal apex to the remnants of the uterosacral ligaments at the level of the ischial spines and cephalad, with incorporation of the (often reconstructed) fibromuscular walls of the anterior and posterior vagina.
FOR ANTERIOR VAGINAL WALL PROLAPSE	
Anterior colporrhaphy	Midline plication of endopelvic fascia of anterior vagina
Paravaginal repair	Attachment of lateral vaginal to arcus tendineous fascia pelvis (either abdominally or vaginally)
FOR POSTERIOR VAGINAL WALL PROLAPSE	
Posterior colporrhaphy	Midline plication of endopelvic fascia of posterior vagina
Posterior site-specific repair	Identification and repair of specific defects in recto-vaginal fascia.
Trans-anal repair	Rectal mucosa separated and the rectovaginal septum is plicated from rectal side.
FOR ANY PROLAPSE	
Colpocleisis	Closure of vagina following removal of most (partial) or all (complete) vaginal skin.

Table 4. Sacrocolpopexy outcomes.

Author	Year	Number of patients, (number lost to follow-up, if known)	Follow –up (months)	Success rate (%)	Criteria for success	Comments
Arthure [34]	1949	50 (2)	NS	90	No recurrence of uterine prolapse or enterocele	Uterus, cervical stump or cuff directly affixed to sacrum
Falk [35]	1961	3 (0)	≤ 36	100	Cured	Uterus, cervical stump or cuff directly affixed to sacrum
Lane [36]	1962	24	NS	92	No recurrence of prolapse	20 patients had the synthetic material stapled to the sacrum, 2 of whom had prolapse recurrence due to staples becoming dislodged from the sacrum
Birnbaum [37]	1973	9 (0)	33	100	Good support	
Rust [38]	1976	12 (0)	24	100	No vaginal vault prolapse	
Feldman [39]	1979	21 (0)	16	95	Adequate vaginal support, sufficient vaginal depth and appropriate vaginal axis	The patient with the failure had apparent detachment of the graft from the apex based upon exam
Cowan [40]	1980	39	30	97	Good vaginal support, no pelvic complaints	Surgical failure involved distal detachment of mesh from vagina
Symmonds [41]	1981	17 (1)	NS	94	Good vaginal support and function	
Lansman [42]	1984	8 (0)	5.5	100	No recurrence of an enterocele or vault prolapse	
Grundsell [43]	1984	9 (0)	46.8	100	No recurrences of vault prolapse	
Addison [43]	1985	56 (2)	39	96	Good vaginal vault suspension in a normal axis	Fascia lata was graft material used for patient with early recurrence 1 patient unimproved as a presacral hemorrhage prevented successful completion of the procedure
Kauppila [45][1]	1985	14 (0)	30	71	Adequate vaginal support on exam	6 of 14 patients had direct attachment of the vaginal apex to presacral fascia, and 4 of these recurred. None of 8 patients in whom graft was used recurred.
Kauppila [46]	1986	9 (0)	50	100	Excellent vaginal support on exam	Fascial grafts used to suspend the cuff in all patients
Drutz [47]	1987	15 (0)	28	93	Well-supported vault	1 patient with recurrent vault prolapse was the only with direct attachment of the vagina to the promontory
Angulo [48]	1989	18 (0)	13	100	Free of symptoms that caused consultation and no degree of prolapse found on vaginal exam	
Baker [49]	1990	59 (6)	6	100	No complaint of protrusion from the vagin	51/59 patients had postoperative records available, at which time all patients had a well-supported vagina

Table 4. Sacrocolpopexy outcomes (continued)

Author	Year	Number of patients, (number lost to follow-up, if known)	Follow –up (months)	Success rate (%)	Criteria for success	Comments
Maloney [50]	1990	10 (0)	26	90	Complete relief of symptoms	
Creighton [51]	1991	23	17	91	No vault prolapse on exam and no complaints of prolapse	
Snyder [52]	1991	147 (15)	43	93 (108/116)	Lack of major long-term postoperative complications, restoration of functional vagina in the proper axis, and no recurrence of presenting symptoms with at least 6 months of follow-up	Graft attached to the entire length of the vagina in the rectovaginal septum
Imparato [53]	1992	71 (8)	NS	78	Excellent, well-suspended vault on exam	50 had direct attachment of the vaginal apex to the anterior sacrum
				16	Good vault suspension, but asymptomatic vaginal "relaxation"	
Timmons [54]	1992	163	33	99	Good vaginal vault support	
Traiman [55]	1992	9 (0)	36.5	91	Good results on exam	1/2 patients with direct attachment of the vagina to the sacral promontory failed
Iosif [56]	1993	40 (0)	36	97	Complete symptom relief, no vault prolapse	Patient with failure had detached graft from apex
van Lindert [57]	1993	61	32	97	No recurrent vaginal prolapse	8 patients had preservation of the uterus
Grunberger [58]	1994	62 (14)	75.6	94	No moderate vaginal vault prolapse on exam	42 patients had direct attachment of the vagina to the sacral promontory 12 had permanent "suture bridges" 8 had lyodura loops
Lecuru [59]**	1994	203	32.5	86.7-100	Anatomically good results	The range of success is due to 4 different techniques which were compared
				53.3-80.5	Functionally good results	
Nezhat [60]	1994	15 (0)	3 – 40	100	Complete relief of symptoms, excellent vaginal vault support	All cases done laparoscopically; 1 converted to laparotomy
Valaitis [61]	1994	41 (2)	21	88	No third degree enterocele on exam, no symptomatic enterocele	One failure had direct attachment of the vagina to the sacrum
Virtanen [62]	1994	30 (3)	36	85	Good vaginal vault support on exam	2 patients with recurrences had failure at the vaginal apex (absorbable sutures)
				85	Patient "satisfied" with the procedure	

Table 4. Sacrocolpopexy outcomes (continued)

Author	Year	Number of patients, (number lost to follow-up, if known)	Follow –up (months)	Success rate (%)	Criteria for success	Comments
Brubaker [63]	1995	65 (0)	3	71	No anterior or apical prolapse	63/65 patients had abdominal anterior compartment repair at the time of the sacrocolpopexy
de Vries [64]	1995	101 (29)	48	32	Fully cured (patient satisfaction based upon questionnaire)	Questionnaires sent to patients to evaluate pain, prolapse-related complaints and functional disorders. Patients indicated symptoms before surgery, >1 year after surgery, and >1 year after surgery
				39	Considerable improvement	
				29	No improvement	
Benson [25]	1996	40	60	58 (another 26% of patients had "satisfactory" outcomes)	Patient asymptomatic, vaginal apex supported above the levator plate, no protrusion beyond the hymen	All patients had sacrocolpopexy and paravaginal repair. Results are from a RCT comparing sacrocolpopexy to sacrospinous suspension.
Hardiman [65]	1996	80	47	99	No recurrent vault prolapse	
Cundiff [66]	1997	19 (0)	11 weeks	100	No prolapse > stage II (63% stage 0, 21% stage I, 16% stage II)	Abdominal sacral colpoperineopexy performed in all patients due to posterior compartment defects and perineal descent associated with vaginal vault prolapse
Ross [67]	1997	19 (2)	12	100	No recurrent vault prolapse at 6 weeks or 1 year postoperatively	All patients underwent laparoscopic sacral colpopexy, Burch colposuspension and modified culpoplasty, with paravaginal defect repairs and posterior colporrhaphy added as indicated
Costantini [68]	1998	21 (0)	31.6	90	Overall satisfaction per postoperative questionnaire; in all patients prolapse was reduced on exam postoperatively	7 patients underwent hysterosacropexy
Occelli [69]**	1999	271 (54)	66	97.7	Cured for prolapse	
Patsner [70]	1999	175 (0)	≥ 12	97	No "mesh failures"	
Pilsgaard [71]	1999	35 (4)	24	97	No recurrent vault prolapse	The 1 patient with recurrent vault prolapse was noted to have the mesh detached from the promontory
Schettini [72]	1999	15 (0)	15	100	High position of the vaginal apex	
Sze [73]	1999	56 (9)	23	81	No recurrent prolapse to or beyond the hymen	All 9 patients with recurrent prolapse were symptomatic
Diana [74]	2000	15	20	100	No relapse of the treated prolapses	

Table 4. Sacrocolpopexy outcomes (continued)

Author	Year	Number of patients, (number lost to follow-up, if known)	Follow –up (months)	Success rate (%)	Criteria for success	Comments
Fox [75]	2000	29	14	100	> Stage I prolapse at any site	Procedure involved sacrocolpopexy and mesh interposition for the correction of both vault prolapse and rectocele
Nieminen [76]	2000	26 (6)	105	64	Any symptomatic prolapse, or asymptomatic stage II-IV prolapse	Direct attachment of the vagina to the sacrum in 4 patients
Winters [77]	2000	20 (0)	11	100	No recurrent enterocele or vault prolapse	
Baessler [78]	2001	33 (2)	26	100	No recurrence of vaginal vault prolapse enterocele or anterior rectal wall prolapse	Attempted to correnct rectoceles abdominally with extension of the graft
Geomini [79]	2001	45 (5)	38	93	No vault prolapse	Culdoplasty done only selectively; 2/3 failures were noted to be a result of graft detachment from the vagina (staples and a tacker used for attachment)
Scarpero [80]	2001	20	11	100	No recurrent enterocele or vault prolapse	All patients underwent sacrocolpopexy, Halban's culdoplasty and paravaginal repair
Sullivan [81]	2001	236 (31)	64	100	No recurrence of vaginal or rectal prolapse	Total pelvic mesh repair involved attachment mesh strip between the perineal body and the sacrum, and then attaching two additional strips laterally to the pubis to support the vagina and bladder
				34%	Very satisfied	
				38%	Satisfied	
Collopy [82]	2002	89 (0)	56.7	100	No recurrence of rectal or vaginal vault prolapse	All had concomitant culdoplasty
Cosson [83]	2002	77 (12)	12	94	No evidence of clinical prolapse	All patients had a laparoscopic sacropexy with other procedures as indicated; 6 other patients had attempted laparoscopic surgery, but required conversion to a laparotomy
Culligan [84]	2002	245	61.2	85	Any POP-Q point ≥ 2	No apical failures observed
Lefranc [85]	2002	85 (0)	126 (median)	90.6	No relapse of any prolapse	All patients without preoperative SUI had a prophylactic Burch procedure done
Leonardo [86]	2002	25 (0)	48	100	No recurrent prolapse	
Lindeque [87]	2002	262 (0)	≥ 16	99	No vaginal vault prolapse	1/3 failures due to graft detachment from vagina
Medina [88]	2002	97 (1)	19	90	< Grade I prolapse	Etiology of 1 failure was graft detachment from the vagina (etiology of other 4 unknown)

Table 4. Sacrocolpopexy outcomes (continued)

Author	Year	Number of patients, (number lost to follow-up, if known)	Follow –up (months)	Success rate (%)	Criteria for success	Comments
Culligan [84]	2002	245	61.2	85	Any POP-Q point ≥ 2	No apical failures observed
Lefranc [85]	2002	85 (0)	126 (median)	90.6	No relapse of any prolapse	All patients without preoperative SUI had a prophylactic Burch procedure done
Leonardo [86]	2002	25 (0)	48	100	No recurrent prolapse	
Lindeque [87]	2002	262 (0)	≥ 16	99	No vaginal vault prolapse	1/3 failures due to graft detachment from vagina
Medina [88]	2002	97 (1)	19	90	< Grade I prolapse	Etiology of 1 failure was graft detachment from the vagina (etiology of other 4 unknown)
Reddy [89]	2002	11 (0)	60	100	No prolapse symptoms or vault prolapse based upon patient questionnaire	
				64	Satisfied	
				36	Considerable improvement	
Roovers [90]	2002	12	18	92	No symptomatic genital prolapse	All patients had sacrocolpopexy and RPU
				55	Satisfied with the result of surgery	
Brizzolara [91]	2003	124	36	98	No recurrent vault prolapse	
Marinkovic [92]	2003	12 (0)	39	83	No recurrent prolapse (anterior, posterior, or vault)	
Sanz [93]	2003	11	12-24	100	Excellent vaginal support, no recurrence of prolapse	A suture anchor system was used for placement of the suture in the mesh at the sacrum
Podratz [94]	1995	50(6)	70	70	Asymptomatic (including no incontinence) and durable repair by exam	
Hilger [95]	2003	69(31)	164	74	Subsequent POP operation or a positive response to question 5 on the PFDI***	
Lo [96]	1998	52 (not clear)	25	94	No prolapse > Stage II	Results are from a RCT comparing sacrocolpopexy to sacrospinous ligament suspension.
Maher [22]	2004	47 (1)	24	76% objective 94% subjective	Objective: No POP beyond halfway point Subjective: No symptoms of POP	Results are from a RCT comparing sacrocolpopexy to sacrospinous ligament suspension.

NS = not stated
SUI = stress urinary incontinence
RPU = retropubic urethropexy
RCT=randomized clinical trial
*Some patients also included in Addison's series
**Only abstract reviewed (paper not in English)
***Question 5 on the Pelvic Floor Distress Inventory – "Do you usually have a bulge or something falling out that you can see or feel in the vaginal area?"

Gastrointestinal problems may occur following open sacrocolpopexy. One in 20 women in CARE trial experienced significant gastrointestinal morbidity after sacrocolpopexy. Of 322 women in the study, 19 had symptoms of possible ileus or small bowel obstruction; of these, 4 had reoperation for small bowel obstruction, 11 were readmitted for medical management, and 4 had a prolonged initial hospitalization for gastrointestional symptoms [106].

Abdominal sacrocolpopoexy has greater morbidity, higher cost and less dypareunia than vaginal sacrospinous ligament suspension [22, 25]. These disadvantages have prompted surgeons to seek alternatives that maintain the advantages and reduce procedure-associated morbidity.

Laparoscopic sacrocolpopexy is performed in some centres, with and without robotic assistance. Only case series are available for evaluation. Von Theobald et al reported a series of 100 patients with 8 year followup [107]. Higgs reported on 140 consecutive women undergoing laparoscopic sacrocolpopexy with mesh [108]. At a median follow up of 66 months, 66 women were examined and a further 37 had questionnaire data available only. Subjects lost to follow-up were not included in the analysis, and could be failures or successes. Symptomatic improvement was good with 79% subjects reporting prolapse symptoms as “cured” or “improved”, but 39/103 (38%) had persistent symptoms of POP. Anatomic prolapse was seen on exam in 21/66 women examined.

2.Transvaginal Apical Suspension Techniques

Support of the vaginal cuff following hysterectomy is recommended by most authorities, and may be achieved by sacrospinous ligament suspension or reattachment of the uterosacral ligaments to the vaginal cuff, McCall culdoplasty, and Mayo culdoplasty. A single study compared these three methods of transvaginal apical suspension at the time of hysterectomy to determine th efficacy of prevention of posterior enterocele as a proxy for apical support [109].

• Iliococcygeus fascia fixation

There are no randomized trials that support the use of this procedure. Several case series have provided some information. Shull reported that apical support was optimal in 39/42 (83%) of patients, but eight others had apical or other defects [110]. Meeks and colleagues reported a 96% objective cure in 110 women followed up to 13 years [111]. In a retrospective case-control study, Maher and colleagues reported similar subjective (91% v 94%) and objective (53% v 67%) cure rates with iliococcygeus fixation (n=50) compared to sacrospinous fixation (n=78) [112].

• Levator myorrhaphy with apical plication

Francis and Jeffcoate [113] described their retrospective series using levator myorrhaphy with vaginal vault suspension to the plication. A large sponge pack in the rectum is used to avoid overplication and bowel dysfunction. Five of 35 wowen responding to the questionnaire had transient ureteral complications, one requiring re-operation. Seventeen women were quite satisfied, while six were dissatisfied.

• Mayo culdoplasty

A large retrospective series from the Mayo clinic described an 82% satisfaction rate on subjective follow-up with few complications [114]. It may achieve its suspension in a mechanism similar to the uterosacral ligament suspension, but no direct comparisons have been reported. A retrospective case series of 411 women undergoing Mayo culdoplasty in two other institutions found that a more dorsal “deep” placement of sutures through the uterosacral ligaments reduced the incidence of ureteral obstruction compared to other published series [115].

• Sacrospinous ligament suspension (SSLS)

The sacrospinous ligament suspension was first described in 1958 [116]. The traditional procedure as described by Nichols has been associated with high rates of anterior wall recurrences in some studies [117].

Table 5 contains outcomes from studies that have included SSLS. Uncontrolled retrospective case series and clinical trials in which SSLS was used in one arm suggest that anterior recurrence is more common (6% to 28.5%) than apical recurrence (2.4% to 19%). Reoperation rates after SSLF range from 1.3% to 37%, with all but two series reporting rates less than 7%.

Case series provide the majority of evidence regarding the SSLS complications which include buttock pain and sacral/pudendal neurovascular injury. Sze et al reviewed 22 studies that included 1229 SSLS procedures and reported that 3 patients (0.2%) had life-threatening hemorrhage from sacral or pudendal vascular injury with a 2% transfusion rate [118]. Buttock pain occurred in 3% of patients, with resolution within 6 weeks for most affected women.

• Uterosacral ligament suspention

First described by Miller [126] in 1927 and popularized by Shull [127], this procedure maintains the vaginal axis in the midline and allows adjustment of the vaginal length. A weakness of the procedure is the risk of ureteral injury; therefore intraoperative cystoscopy after the sutures are tied down is an essential part of this procedure. The current evidence supporting the use of ULS is limited to seven uncontrolled retrospective case-series (**Table 6**). In these studies, ULS is associated with low overall recurrence (4% - 18%), anterior vaginal prolapse recurrence of 3.5% - 11%, and reoperation of less than 7%. These promising results are balanced by ureteral injury with this procedure.

Table 5. Anatomic Outcomes from CARE cohort at 3 and 24 months.

POP-Q (mean± SD or N(%))	3 mo Burch N=149	3 mo No Burch N=164	Test	24 mo Burch N=117	24 mo No Burch N=133	Test
Point C	-8.3±1.8	-8.5±1.6	0.07	-8.0±1.5	-8.2±1.3	0.46
Point Ba	-2.6±0.7	-2.0±0.9	<0.001	-2.2±0.9	-1.8±1.1	<0.001
Point Bp	-2.4±0.9	-2.4±0.9	0.70 <0.001	-2.0±1.3	-2.3±0.8	0.006 0.55
Stage						
0	55 (37.7%)	29 (17.8%)		24 (20.5%)	23 (17.4%)	
1	70 (47.9%)	80 (49.1%)		43 (36.8%)	51(38.6%)	
2	19 (13.0%)	53 (32.5%)		46 (39.3%)	57 (43.2%)	
3	2 (1.4%)	1 (0.6%)		4 (3.4%)	1 (0.8%)	

Table 6. Sacrospinous Ligament Suspension Procedures

First Author	**Year**	**No. of Pts.**	**Mean Follow-up Months (range)**	**Definition of anatomic success***	**Anatomic success –all segments**	**Anatomic recurrence by segment**	Reoperation for prolapse
Morley [29]	1988	92	51.6 (1-132)	Not defined	90%	Apex 4% Anterior 6%	4 (5%)
Imparato [53]	1992	155	Not stated	Not defined	90.3%	Not reported	None reported
Shull [119]	1992	81	(24 – 60)	Grade 0-1	82%	Apex 4% Anterior 12% Posterior 1%	4 (5%)
Pasley [120]	1995	144	35 (6-83)	Asymptom-atic and above hymen	85.4%	Apex 5.6% Anterior 7.6% Posterior 1.4%	2 (1.3%)
Benson [25]	1996	42	30 (12-66)	Vaginal walls above hymen or apical descent less than 50% length#	67%	Apex 12% Anterior 28.5% Posterior 2.3%	14 (37%)
Paraiso [121]	1996	243	76. (1-190)	Grade 0 or asymptomatic grade 1	79.7% at 5 years	Apex 4.9% Anterior 15.9% Posterior 4.9%	11 (4.5%)
Penalver [122]	1998	160	40 (18-78)	'any symptomatic descent'	85%	Apex 6% Anterior 6% Posterior 2.5%	11 (6.8%)
Colombo [123]	1998	62	83 (48-108)	Grade 0-1	74%	Apex 8% Anterior 14% Posterior 3%	0 (0%)
Meschia [124]	1999	91	43 (12-86)	Grade 0-1	85%	Apex 4% Anterior 13% Posterior 9%	None reported
Sze [73]	1997	75	24 (3-72)	above hymen	71%	Anterior 21% Other 8%	7 (12.9%)
Lantzsch [125]	2001	123	58 (6 – 108)	Not defined	87%	Apex 3.5% Anterior 8% Posterior 1.6%	2 (1.6%)
Maher [22]	2004	48	22 (6-58)	Grade 0-1	69%	Apex 19% Anterior 14% Posterior 7%	3 (6.3%)

b) Anterior vaginal wall prolapse

1. Anterior colporrhaphy

Since the first description in 1913 by Kelly [134], the success rates of anterior colporrhaphy in the management of cystoceles ranges from 80-100% in retrospective series [135-138] (**Table 7**). Experts agree that there is a great deal of variation in the clinical performance of anterior colporrhaphy. In two separate randomized control trials, Weber et al [139] and Sand et al [140] reported less favorable outcomes with the anterior colporraphy, 42% and 57% respectively. Athough colposuspension is not used as a treatment for anterior vaginal support defects, Colombo et al reported long-term follow-up randomized trial results suggesting that the anterior colporraphy (97% success rate) was superior to the colposuspension (66%) in the management of the cystocele in women with cystocele and stress urinary incontinence [141].

2. Paravaginal repair

In 1976, Richardson [149] popularized the paravaginal repair originally described by White [142] as early as 1912. Several case series have reported that the range of success rate for the abdominal paravaginal repair is 75-97% [149-153] (**Table 8**). While this technique can be duplicated laparoscopically, no efficacy information is available.

Since Shull's [143] initial report on the safety and efficacy of the vaginal paravaginal repair in 1994, several case series have reported success rates between 67 –100% [142-147]. The high success rates have been tempered by complications such as those reported by Mallipeddi [146] in her case series of 45 patients including: 1 bilateral ureteric obstruction, one retropubic haematoma requiring surgery, two vaginal abscesses; two transfusions. In a series of 100 women Young [147] reported a 21 major complications and a 16% transfusion rate.

3. Optimal Route of Surgery

Surgical correction of pelvic organ prolapse can be divided into two main categories: reconstructive procedures to correct anterior and posterior wall defects and resuspend the vaginal apex or obliterative procedures to close off the vagina. Reconstructive surgery may use the vaginal route or the abdominal route. In planning surgery, the individual patient's risk for surgery, risk of recurrence, previous treatments, and surgical goals are all considered in deciding on obliterative versus reconstructive procedures, and in deciding whether the vaginal or the abdominal approach will be used for reconstructive repairs. The goal of this section is to examine the evidence for selecting the surgical route in prolapse repairs.

- Selection of Paravaginal Defect Repair Route (vaginal v abdominal):

No randomized control studies have evaluated the abdominal or vaginal paravaginal repair in isolation. As discussed in the apical section of this chapter, Benson et al [25] and Maher et al [22] have reported RCT's on upper vaginal prolapse comparing abdominal sacral colpopexy and vaginal sacrospinous colpopexy. Abdominal paravaginal repair was performed in the abdominal group if required and an anterior colporrhaphy without or without vaginal paravaginal laterally. Both authors reported the abdominal group to have a statistically lower rate of postoperative anterior vaginal prolapse than the vaginal group.

Raz et al [154] popularized the needle suspension type procedure for cystoceles and success rates in case series vary from 90-98% [154, 155, 156]. The addition of polyglactin mesh to the repair appears to

Table 7. Uterosacral Vault Suspension Procedures

First Author	Year	No. of Pts.	Mean Follow-up Months (range)	Definition of anatomic success*	Anatomic success –all segments	Anatomic recurrence by segment	Reoperation for prolapse
Jenkins [128]	1997	50	(6-48)	Not defined	96%	Anterior 4%	None reported
Comiter [129]	1999	100	17 (6.5-35)	Grade 0-1	96%	Apex 4%	4 (4%)
Barber [130]	2001	46	15.5 (3.5-40)	Stage 0/1 or Stage 2 without symptoms	90%	Apex 5% Anterior 5% Posterior 5%	3 (6.5%)
Karram [131]	2001	168	21.6 (6 -36)	Grade 0-1	88%	Apex 1% Anterior or posterior 11%	11 (5.5%)
Shull [127]	2001	289	Not stated	Grade 0-1	95%	Apex 1% Anterior 3.5% Posterior 1.4%	None reported
Amundsen [132]	2003	33	28 (6-43)	Stage 0 or 1	82%	Apex 6% Posterior 12%	None reported
Silva [133]	2006	72	61.2 (42-90)	Symptomatic Stage 2 or greater	85%	Apex 3% Anterior 7% Posterior 14%	2 (3%)

122

Table 8. Anterior Vaginal Wall Prolapse Procedures

Author	Year	No.	Follow-up	Success Rate
Anterior Colporrhaphy				
Stanton [137]	1982	54	up to 2 yrs	85%
Macer [135]	1978	109	5-20yrs	80%
Walter [138]	1982	76	1.2yrs	100%
Porges [136]	1994	388	2.6yrs	97%
Colombo [141]	2000	33 AC 35 colposupension	8-17yrs 8-17 yrs	97% 66%
Sand [140]	2001	70 AC 73 AC& mesh	1yr 1yr	57% 75% No mesh complications
Weber [139]	2001	57 AC 26 AC+mesh	23month 23 month	37% 42% No mesh complications
Vaginal Paravaginal Repair				
White [142]	1912	19	up to 3 yrs	100%
Shull [143]	1994	62	.6 yrs	67%
Grody [144]	1995	72	0.5-3yrs	99%
Elkins [145]	2000	25	0.5-3yrs	92%
Mallipeddi [146]	2001	45	.6yrs	97%
Young [147]	2001	100	11 months	78%
Morse [148]	2007	27 VPVR 86 AC	13 24	54% 45%
Abdominal Paravaginal Repair				
Richardson [149]	1976	60	1.7yrs	97%
Richardson [150]	1981	213	0.5-6yrs	95%
Shull [151]	1989	149	0.5-4yrs	95%
Bruce [152]	1999	27 APR& sling 25 APR	17 months 17 months	93% 76%
Scotti [153]	1998	40	39 months	97%
Sling type support				
Raz [154]	1989	107 AC & needle	2yrs	98%
Raz [155]	1991	50	2.8yrs	90%
Gardy [156]	1991	58 AC & needle	2yrs	95%
Benirzi [157]	1996	36 AC & vaginal wall sling	17months	95%
Dmochowski [158]	1997	47 Raz type	47months	43%
Cross [159]	1997	36 AC & sling	20months	92%
Safir [160]	1999	112 Raz + polyglactin mesh	21months	92%
Goldberg [161]	2001	53 AC& sling	1 yr	81%
		90 AC	1yr	58%

APR Abdominal paravaginal repair

AC Anterior colporrhaphy

Definition varies between authors

have little impact on the success [160]. Dmochowski et al [158] reported a lower success rate using a stricter outcome definition of success.

Goldberg et al [161] reported results from a case control study of women with cystocele and stress urinary incontinence. He suggests that the addition of the pubovaginal sling to the anterior colporrhaphy significantly reduced the recurrence rate of cystocele from 42% in the control group to 19% in the anterior colporrhaphy and sling group (P<0.05).

The surgical management of anterior vaginal prolapse remains controversial. In reconstructive gynaecology surgery Level 1 [22, 25] evidence suggest the combined use of abdominal sacral colpopexy with or without retropubic colposuspension or paravaginal repair is superior to the vaginal approach including sacrospinous colpopexy and anterior colporrhaphy with or without vaginal paravaginal repair in the management of anterior vaginal prolapse (Grade B recommendation).

Level 2 evidence suggests that in women with stress urinary incontinence and anterior vaginal support defects, the addition of a sling at the time of anterior colporrhaphy enhances anatomical outcome as compared to anterior colporrhaphy alone or in combination with other continence surgery [140, 161]. This evidence arises from one institution and one sample of women is reported twice.

c) Posterior vaginal wall prolapse

In standard posterior colporraphy, the posterior vaginal wall is incised in the midline and rectovaginal fascia identified. The fascia is then approximated in the midline either with continuous or interrupted absorbable suture. In the traditional technique described by Jeffcote [113], this was supplemented with levator ani muscle approximation in the midline.

With the site specific defect repair, following posterior vaginotomy, the defects in the rectovaginal fascia are identified with a rectal finger bringing the rectal wall forward. The connective tissues are pulled across over the defects and sutured with absorbable sutures to close the defect.

1. Midline Plication (traditional posterior colporrhaphy)

In five studies, where traditional posterior colporraphy was evaluated, the success rate ranged from 76% to 97% (**Table 8**), while postoperative dyspareunia rates range from 11 to 27% (Table 8) with denovo dyspareunia rates of 4% to 16% [137, 162-164]. This has been attributed to levator ani plication forming a rigid band across the vagina. Midline fascial plication of rectovaginal fascia without levator plication is believed to reduce this high rate of dyspareunia.

2. Site specific defect repair

Richardson identified discrete defects in rectovaginal fascia and directed repair at the specific sites of defect to produce a more anatomical repair [169]. Both prospective and retrospective case series on the site specific defect repair, have reported success rates in the range of 67-92% with good functional outcomes (**Table 9**) [167, 170-172]. Table 9 contains a summary of reports using site specific defect repair for posterior vaginal support defects. One uncontrolled comparison of posterior colporrhaphy with site-specific defect repair [173] reported that the recurrence risk was higher in the site specific group at the end of 1 year follow-up (33% vs. 14%) and the postoperative Bp point was (-2.2 SSDR vs. - 2.7 PCR) P=0.001. The functional outcomes of difficult evacuation, fecal incontinence and post-operative dyspareunia were similar in both groups.

Posterior vaginal wall prolapse repair has traditionally used the vaginal approach, although several studies

Table 9. Midline Fascial Plication (traditional posterior colporrhaphy)

Author	N	Follow-up	Success	Dyspareunia	
				Pre-op	Post-op
Kahn M (164)	171	43 months	76%		
Lopez A* (163)	24	5 years	91%	6%	20%
Arnold W (162)	29	4 years	77%	-	23%
Mellgren A* (165)	25	12 months	96%	6%	19%
Maher C** (166)	38	12 months	97 %	52%	11%
Singh (167)	42	18 month	92%	31%	12%
Robinson (168)	34	41 mos (mean)	NR	33%	10%

*includes levatorplasty

**without levatorplasty

address the transanal / transperineal approaches. The threshold for surgical intervention in the posterior wall has been poorly studied and the relationship between symptoms and anatomy is particularly poorly understood. There is insufficient evidence to recommend a surgical threshold based on anatomical support loss. Symptoms that have been associated with posterior wall prolapse include difficult defecation and splinting. Constipation is recognized as a colonic motility disorder that is not treated by posterior vaginal surgery.

The transvaginal approach appears to be superior to the transanal approach for repair of posterior wall prolapse. Two prospective randomized controlled trials compared the transvaginal and transanal techniques. Nieminen et al reported one-year outcomes for 30 women with symptomatic rectocele who were randomly assigned to vaginal vs. transanal surgery [175]. Despite the small sample size of this group, they reported superiority of the transvaginal route with significant differences in recurrence rate (7% vs. 40%, p=0.04) and symptom improvement (93% vs. 73%, p=0.08) in the transvaginal and transanal groups respectively. No differences were reported in post-operative splinting or sexual function, perhaps due to the small sample size. Improved posterior support was reported with the transvaginal point (POP-Q Ap point -2.8 vs. -1.36). Kahn et al reported the superiority of the 2 year anatomic outcomes transvaginal route in 57 women randomly allocated to transvaginal (N=24) vs. transanal repair (N=33) with 13 % vs. 30%, (p=0.01) respectively [164].

Puigdollers et al reported results from a prospective cohort of women with rectocele and constipation who underwent surgery via endorectal or transperineal route, according to preference of the surgeon). At the end of one year the subjective improvement in constipation was reported in 43% ($p < 0.001$) and the need to splint decreased in 52%.(p=0.001) [176].

A single non-randomized study reports outcomes for a cohort of women with symptomatic rectocele who were treated laparoscopically (N=40) vs. transanally (n=40). Level 2B evidence from this study supports the superiority of the transanal approach for symptomatic relief (55% vs. 28%, $p < 0.02$), but lower post-operative dysparenuia rates (22% vs. 36%) with laparoscopic approach [177].

Paraiso et al compared three techniques of vaginal repair – posterior colporrhaphy (PCR), site specific repair (SSDR) and graft augmentation with site specific repair by prospective RCT [174]. Women randomly assigned to the posterior colporrhaphy (n= 37) and the site-specific repair group (n= 37) were reviewed at 17 months. The anatomical success rates were 86% and 78% respectively in the PCR vs. SSDR group. The functional outcomes of difficult evacuation and vaginal digitations were similar in both groups, and there was improvement in the PISQ –12 scores in all the treatment groups. The dyspareunia rates were 20% in the PCR compared to 14% in the SSDR. The anatomical and functional outcomes between SSDR and PCR were similar in this study. These studies do not provide evidence to support use of augmenting materials for posterior prolapse repair.

3. Modifications to traditional repairs

In the case series by Van Dam J H et al combined transvaginal and transanal repair was done in 89 women and evaluated at a follow-up of 52 months. The anatomical success rate was 71% with no persistent or recurrent rectocele on defecography at 6 months. However, denovo dyspareunia was reported in 41% of women and there was deterioration of fecal incontinence in 7 patients [178].

The abdominal route has been employed in the correction of posterior vaginal wall prolapse when a co-existing apical defect required surgery. The technique is a modification of sacrocolpopexy with extension of the posterior mesh to the rectovaginal septum or upto the perineal body. The procedure has been performed completely abdominally or as a combined abdominal and vaginal approach. **Table 10** summarizes a series of studies using extended posterior fixation of sacrocolopexy mesh.

Table 10. Site specific defect repair (SSDR)

Author	N	Follow-up	Success	Dyspareunia	
				Pre-op	Post-op
Abramov Y [173]	124 (SSDR)	14 months	67%	8%	16%
	183 (PCR)		86%	8%	17%
Cundiff G [170]	69	12 months	82%	29%	19%
Kenton K [171]	66	12 months	77%	26%	8%
Porter [172]	89	18 months	82%	67%	46%
Paraiso [174]	37 (SSDR)	17 months	78%	9%	14%
	27 (PCR)		86%	30%	20%

2. OBLITERATIVE PROCEDURES: LeFort colpocleisis, Colpectomy and colpocleisis

These procedures are offered to women with Stage II-IV POP seeking a relatively non-invasive surgical procedure with cure rates as high as 100% [181] and who no longer wish to preserve coital function per vaginam (**Table 11**). With partial colpocleisis (for vaginal vault prolapse) or LeFort colpocleisis (for uterine prolapse), rectangles of vaginal epithelium are excised from the dorsal and ventral surfaces of the prolapsed vagina. The vagina is inverted and closed with the two raw surfaces in direct contact and reinforced with sutured skin edges. A small amount of skin is usually preserved on each side of the vagina, speeding the excision and allowing drainage of any secretions. The enterocele need not be addressed because there is no longer room in the vagina to permit descent, and the uterus can be left in situ unless there is separate pathology. In total colpectomy, all vaginal skin is removed, often including a high levator myorrphaphy.

In the U.S., the number of colpocleises has declined from a high of 17, 200 procedures in 1992 to a low of 900 procedures in 1997 [24], while the number of total colpectomies decreased from a high of 3229 in 1989 to a low of 32 procedures in 1995. Nevertheless, obliterative procedures have an important role to play in the management of POP: in many women, the loss of coital function is offset by the positive impact on their daily activities. These procedures are performed on an outpatient basis with an immediate return to normal activities, and success rates have been described as high as 100%. High rates of patient satisfaction have been reported [182, 183] with low rates of regret for loss of sexual function. Barber et al reported results from a multicenter study followed by a prospective cohort design with a concurrent control group (184). Despite permanent alterations in sexual function and potential alterations in self-image, iImprovements in quality of life for the thirty women aged 65 or older who selected obliterative prolapse surgery were similar to the concurrent cohort of forth women who selected reconstructive surgery.

The Pelvic Floor Disorders Network recently completed a large series of women undergoing colpocleisis with one year follow-up [185]. All pelvic symptom scores and related bother significantly improved at 3 and 12 months, and 125 (95%) patients said they were either ‘very satisfied’ or ‘satisfied’ with the outcome of their surgery. These investigators concluded that colpocleisis was associated with high patient satisfaction.and was effective in resolving prolapse and pelvic symptoms.

Table 11. Abdominal Repair (Posterior Extension of Colpopexy Mesh)

Author	N	Follow-up	Success	Dyspareunia Pre-op	Post-op
Baessler K [78]	33	26 months	45%	39%	13%
Fox S [75]	29	14 months	90%	38%	17%
Su K [179]	122	12 months	90%	-	-
Lyons [180]	20	12 months	80%	-	-
Marinkovic [92]	12	39 months	91%	29%	none

*Laparoscopic approach

Table 12. Post-Colpocleisis Anatomic Measures. (Data available for 146 patients at baseline, 110 at 3 months and 103 12 months after surgery)

	Baseline	3 Mos Post-op	12 Mos Post-op
Most distal vaginal point (leading edge)			
≤ 1cm inside hymen			
≤ 1cm beyond hymen			
> 1cm beyond hymen	0 (0%)	90/110 (82%)	75/103 (73%)
	0 (0%)	107/110 (97%)	96/103 (93%)
	146/146 (100%)	3/110 (3%)	7/103 (7%)

IV. CONCOMITANT SURGERY

1. EFFECT OF COMBINATION PROCEDURES

With apical suspensions: The success of anterior wall support procedures seems to interact with concomitant vaginal apical suspension procedures. Paraiso et al [121] reported a 37% cystocele rate after 243 women had undergone sacrospinous colpopexy and suggested the rate of cystocele may decrease with the iliococcygeous fixation as there was less posterior displacement of the vault. Subsequently, Maher et al [112] reported high rates of cystoceles after both sacrospinous and iliococcygeous fixation.

With bladder neck suspension, Kohli et al [186] found the concomitant use of transvaginal bladder neck suspension used in conjunction with the anterior colporrhaphy was also problematic. Women undergoing anterior colporrhaphy alone had a 7 % recurrence rate as compared to a 33% recurrence rate after combined anterior colporrhaphy.

2. HYSTERECTOMY - The Role of Hysterectomy in Surgical Treatment of Prolapse

Hysterectomy at the time of POP repairs is the standard practice in most parts of the world despite the fact that descent of the uterus may be a consequence, not a cause of POP. Surprisingly, given its widespread use, concomitant hysterectomy is not an evidence-based practice. Increasingly, women may wish to avoid hysterectomy at the time of POP repairs because of factors such as desire for further childbearing, the belief that the uterus is important for sexual satisfaction, and the success of recent conservative procedures for uterine bleeding and fibroids. While there are no prospective comparative trials, a few smaller studies suggest that there may be no disadvantage in outcome with conservation of the uterus, and operating time is shorter. Well-designed RCT studies comparing the repair of POP with and without hysterectomy should be prioritized.

Several studies report results of preservation of the uterus with sacrohysteropexy. Banu 1997 [187] reported 100% success in a case series of 19 women with following sacrohysteropexy using mersilene mesh at 3-5 year follow-up. Leron 2001 [188] reported 92% success with the same procedure using teflon mesh in 13 subjects at a mean 15.6 months. Maher 2001 used a laparoscopic-assisted high McCall procedure for hysteropexy in 43 patients, with a reported 79% success rate at a mean 12 months follow-up [189]. Jeon, et al [190] reported outcomes after a median follow-up of 36 months in their retrospective comparison of 168 patients in 3 groups: sacrocolpopexy with synthetic mesh and hysterectomy (N=63); abdominosacral uteropexy with mesh (N=35), and abdominal uterosacrocardinal colpopexy and hysterectomy (N=70). Recurrence in the latter group III was 6.2 times higher than in the sacrocolpopexy/ hysterectomy group, however due to the design and group size, specific hypothesis testing was not possible.

Dietz [191] and co-workers observed 133 Dutch women undergoing a sacrospinous hysteropexy, and examined 60 of these women with mean followup of 22.5 months. Eight-four percent of women were highly satisfied about the outcome of the procedure, and the rate of reoperation for uterine descent was 2.3%. The recurrence of anterior wall defects in this study was 35%.

Three studies describe uterine preservation at the time of vaginal reconstruction. Uterine preservation or removal did not appear to affect the risk of POP recurrence, although these studies are significantly underpowered.

Maher et al [189] reported a retrospective comparison of 34 sacrospinous hysteropexies and 36 vaginal hysterectomies with sacrospinous fixation. Uterine conservation was associated with significantly less blood loss (198 vs 402 ml) and decreased operating time (59 vs. 91 minutes). At a 36 month mean follow-up in the hysterectomy group and a slightly shorter follow-up of 26 months in the hysteropexy group, the investigators did not detect differences in subjective success (86% vs. 78%, p=0.70), objective success 72% vs. 74%, p=1.00) or patient-determined satisfaction (86% vs. 85%, p=0.10).

Hefni [192] et al reported a nonrandomized prospective controlled study of 109 women who underwent sacrospinous cervicocolpopexy with uterine conservation [61 (56%)] and sacrospinous colpopexy + vaginal hysterectomy [48 (44%)]. Uterine conservation was associated with significantly less blood loss, decreased operating time and complication rate. At approximately 34 months, anatomic success was similar for the upper vaginal support (93.5% vs. 95%), anterior wall (11.4% vs. 10.4%, p=0.9) and re-operation (5% vs. 4.2%) for the uterine conserving vs. hysterectomy groups respectively.

Van Brummen [193] performed a retrospective comparison of the same two procedures (n=30 with hyst, 44 with hysteropexy) and recurrence of prolapse defined as $\geq$ grade 2 was similar in hysterectomy (2/30, 6.7%) and women with uterine preservation (5/44, 11.4%)

Neuman at al [194] reported their prospective non-randomised series in an abstract comparing 44 patients undergoing Posterior Intravaginal Sling (PIVS) with (N=44) and without (N=35) hysterectomy according to the patient's preference. The women who selected uterine conservation were younger (51 vs. 63 yrs). With mean follow-up of 30 months, the

investigators did not detect a significant difference in anatomical results (98.7), patient satisfaction (89.9%), or perioperative morbidity.

• Risks of concomitant hysterectomy

There is growing evidence that concomitant hysterectomy increases the risk of suture or mesh erosion at the time of sacrocolpopexy. Cundiff et al, [32] in a prospectively planned analysis of the randomized CARE trial, reported that hysterectomy increases the risk of suture/mesh erosion. There are no comparative studies of complete vs. supracervical hysterectomy at the time of sacrocolpopexy to address the appropriate clinical treatment, given this finding.

Several case series have addressed specific risks that concomitant hysterectomy may confer at the time of prolapse repair, especially with regard to concomitant synthetic mesh use. Federow [195] did not detect significant differences in short-term post-op febrile morbidity, haemoglobin change or duration of hospital stay in a series of 235 sacrocolpopexy patients, 36.6% of whom had concomitant total abdominal hysterectomy.

Belot et al reported that an inverted T-colopotomy and concomitant hysterectomy increased the risk of mesh erosions fourfold [196]. Gauruden -Burmester reported on 120 women, 12 months following armed monofilament polypropylene mesh with a mesh erosion rate of 3% which was not affected by performance of inverted T-colpotomy in over 50% (197). Collinet et al (198) reported that concomitant hysterectomy at the time of mesh-augmented vaginal reconstructive surgery increases the risk of mesh erosion [OR = 5.17 (p = 0.003] in his retrospective series of 277 patients.

One non-randomized comparative study of 124 women reported by Brizzolara et al suggests that concomitant hysterectomy (n=60) is not a risk factor for mesh erosion [91].

Concomitant culdoplasty. There is insufficient evidence to comment on the utility of concomitant culdoplasty at the time of prolapse repair by any method.

3. CONTINENCE TREATMENT (Treatment and Prophylaxis)

Although many women with anterior vaginal wall prolapse also experience stress urinary incontinence, women with advanced prolapse may not have incontinence symptoms. There is no standardized nomenclature to describe clinical or urodynamic findings for stress continent women who exhibit urine loss during prolapse reduction testing. In published papers, the terms “occult”, “potential”, “masked”, “latent”, “hidden” and “iatrogenic” are used interchangeably to describe SUI, which occurs following POP surgery in symptom-free patients before surgery. Conventionally, occult stress incontinence is diagnosed when leaking occurs with Valsalva maneuvers after reduction of the prolapse in the absence of detrusor contractions. Using these criteria, incidence of occult stress incontinence has been shown to range between 36% and 80% [12].

Many case series have documented the risk of *de novo* SUI following POP repair with the incidence of *de novo* postoperative stress incontinence in patients with a negative preoperative reduction cough stress test has been showed to be 1.9% [199] in a recent retrospective chart review study. Concomitantly, a 67.9% prevalence of occult SUI has been reported in a population of 78 women with POP[200].

The pre-operative lack of symptoms in some women who experience *de novo* SUI following POP surgery is due to anatomic obstruction of the kinked urethra [201], and may have voiding difficulties due to similar urethral mechanics [202]. Techniques for prolapse reduction to optimally predict the risk of post-operative SUI has not been evidence-based. Visco et al (203) reported that certain techniques have poor predictive values for predicting de novo SUI following sacro-colpopexy .

Level 1 evidence exists from the CARE study which randomized 322 stress-continent women with Stage II-IV POP to a Burch colposuspension or no continence procedure at the time of concomitant open abdominal sacrocolpopexy [11]. The trial ended when the first planned interim analysis demonstrated the significant reduction of *de novo* SUI three months after surgery in women who were assigned to the Burch colpo-suspension compared to the group without a continence procedure. This benefit was not offset by any untoward intra-operative or post-operative side effects such as worsening urge incontinence or voiding dysfunction. These benefits were maintained at one year [13] and two years [14].

In the trial reported by Costantini, et al, [204] 66 patients with a negative stress test before and after prolapse reduction and no preoperative history of SUI symptoms were randomized to colposuspension or no colposuspension with a mean follow-up of 39.5 months. The pre- and post-operative definitions are not consistently defined or standardized. Although this paper does not support the routine use of colposuspension at the time of sacrocolpopexy in patients with negative preoperative stress test, the study was significantly underpowered and concluded the concomitant colposuspension increases the rate of post-operative stress incontinence.

The contradictory results between these two studies may be due to different inclusion criteria or differences in sacrocolpopexy technique. Participants in the CARE study were randomized without regard to results of urodynamic testing with prolapse reduction, in order to determine the pre-operative utility of such testing.

Given the overall benefit of the Burch colposuspension, the recommendations did not change based on reduction testing results; however, women who demonstrated preoperative urodynamic stress incontinence during prolapse reduction were more likely to report postoperative SUI, regardless of concomitant colposuspension (in the control group 58% versus 38% (p=0.04) and in the Burch group 32% versus 21% (p=0.19)) and experience a higher risk of postoperative SUI [203].

Tables 12 and 13 summarize studies of prophylactic continence procedures. Several randomized trials have reported lack of effect when a prophylactic bladder neck procedure is performed among continent women. Bump et al randomized 29 women with stage III-IV prolapse but without stress incontinence to either a needle suspension or endopelvic fascial placation without detecting a difference in urinary continence [28].

Similarly Colombo et. al. did not find differences in continence outcomes following randomization of 102 women with stage 2-4 prolapse without stress incontinence to cystopexy with or without pubourethral ligament plication [141]. Meschia et al reported results from their single small randomized clinical trial that addressed the surgical stress incontinence prophylaxis with TVT® at the time of vaginal prolapse surgery [205]. Although this was a positive trial, only women who were incontinent with prolapse reduction were included and any de novo incontinence, regardless of bother, was used as an endpoint. Thus, the use of prophylactic TVT® (or other prophylaxis) among women who are continent with prolapse reduction remains an unanswered but important clinical question. A recent prospective randomized trial has shown that anterior mesh repairs are more likely to lead to postoperative SUI than colporrhaphy alone (23% to 10% respectively) [206] (**Tables 13, 14**).

The Effect of Concomitant Continence Surgery on Prolapse Outcome:

a) Concomitant Sling

Goldberg et al reported that a suburethral sling is protective in the anterior wall [161]. In a randomized trial designed to evaluate the efficacy of cadaveric fascia patch for augmentation of anterior colporrhaphy, Gandhi et al reported that concomitant sling placement reduces anterior wall recurrence [221].

b) Concomitant Colposuspension

In a secondary analysis of a randomized controlled trial of the utility of Burch colposuspension for prevention of post-operative stress incontinence, Brubaker et al reported that Burch colposuspension at the time of open sacrocolpopexy results in anatomical changes that improve anterior support and decrease posterior vaginal wall support (Table 4) [14].

4. CONCOMITANT PERIOPERATIVE PELVIC PHYSICAL THERAPY

Jarvis et al reported the only study to date that has evaluated perioperative pelvic muscle training in women undergoing prolapse surgery [222]. Three months after surgery, subjects in the intervention group had significantly greater reduction in urinary symptoms, including reduction in daytime urinary frequency, and greater improvement in quality of life compared to the control group. Subjects were not followed beyond 3 months postoperatively, however, and only urinary symptoms were assessed. The role of perioperative pelvic muscle training for reducing the recurrence of prolapse or its symptoms in the long-term is unknown.

a) Risk factors for POP and their relationship to the choice of surgical route

Experts believe that it is important to understand the specific risk factors for an individual patient in planning her surgical correction POP results from a continuum of predisposing, inciting, promoting, and decompensating factors [223]. There are limited data regarding risk factors for POP recurrence after surgery, but expert opinion supports the concept that there are certain women who are at high risk for primary and/or recurrent POP. Some established risk factors for primary POP include vaginal delivery, age, obesity, and family history.Most experts recommend that, whenever feasible, POP repair be delayed until after childbearing is complete. As older women may have increased surgical risks compared to younger women [224] some surgeons may advocate the vaginal approach avoiding an incision. Obesity may be viewed as a separate risk for abdominal surgery, with the vaginal approach avoiding the risk associated with an abdominal wall incision [225].

There is no evidence to guide clinical decision making for the woman who develops POP without evident risk factors, such as the young woman or the nulliparous woman. In fact, one study of nulliparous nuns and their multiparous sisters reveals similar rates of POP in siblings after menopause, regardless of parity [226]. Younger women needing repair of POP often choose the most durable procedure allowing coital function.

Expert opinion is supported by level 2 evidence that there are certain women who are at high risk for primary and/or recurrent POP). Dietz-Itza and co-workers [191] found that women with increased body weight (>65 kg) and women under 60 years of age had increase in both anatomical and functional recurrence of prolapse. Women with more severe prolapse are more likely to recur than those with milder support abnormalities.

Other factors are not considered to be risk factors for POP but influence surgery itself. Obviously

Table 13. SUI prevention at the time of vaginal surgery biologic grafts (continued)

Author / year type of trial level of evidence	Year	SUI type	Surgery + Follow up	Follow-up	SUI outcome	Comments
Bump [28] prospective randomized Level 2	1996	Occult USI (Pressure transmission ratio < 90% or positive stress test during barrier testing) n = 20	Needle urethropexy (Muzsnaï) n = 10	6 weeks and 6 months	Needle urethropexy group: SUI = 7% at 6 weeks 14 % at 6 mos.	Needle urethropexy group: urge incontinence 58% at 6 weeks - (36% de novo) 14% at 6 mos.
			Fascia plication n = 10			
		Without occult SUI n = 9	Needle colposusp. n = 4		Fascia plication group SUI 21% at 6 weeks 7% at 6 mos.	Plication group: Urge incontinence 0% at 6 weeks 7% at 6 mos.
			fascia plication n = 5			
Colombo [207] randomized Level 1	1996	Negative stress test with prolapse reduction	Cystopecy n = 52	2.6 +/- 1.7 y.	SUI : 8%	1 reoperation 0 long term micturition disorders 2% symptomatic OAB
			Cystopexy + pubourethral ligaments plication n = 50	2.9 +/- 1.8 y.	SUI : 8%	1 reoperation 10% long term micturition disorders 2% symptomatic OAB
Colombo [208] randomized Level 1	1997	Overt SUI	post pubourethral ligt plication n = 15	> 5 y.	SUI : 40%	4% symptomatic OAB after pubourethral plication
			Pereyra procedure n = 21	''	SUI : 29%	2% symptomatic OAB after Pereyra
		occult SUI	post pubourethral ligt plication n = 40	''	SUI : 15%	
			Pereyra procedure n = 33	''	SUI : 0%	
Gordon [209] prospective case series Level 3	1999	Occult SUI n = 30	Kelly plication	25,5 m.	Subjective and objective SUI: 50% objective SUI with no subjective complaints: 37%	procedure non effective to prevent postoperative SUI in patients undergoing POP repair
Chaikin [210] prospective cohort study Level 2	2000	Occult SUI n = 14	Pubovaginal sling	47 mos. (12-108)	SUI : 14%	1 (7%) de novo urge incontinence
		Negative stress testat reduction n = 10	No additional procedure	44 mos. (12-96)	SUI : 0%	0 de novo urge incontinence
Klutke [211] retrospective. (charts review) Level 4	2000	Occult SUI n = 55	Burch n = 52	3.5 y (1-7)	SUI : 4%	30% de novo detrusor instability
			Needle colposusp. N = 3	''		
		negative stress test with reduction N = 70	No additional procedure	''	SUI : 0%	5% de novo detrusor instability

Table 13. SUI prevention at the time of vaginal surgery biologic grafts (continued)

Author / year type of trial level of evidence	Year	SUI type	Surgery + Follow up	Follow-up	SUI outcome	Comments
Groutz [212] Prospective Level 3	2000	occult SUI n = 30	Stamey	8 mos. (3-19)	Symptomatic urodynamically confirmed SUI 23.3% asymptomatic patients with positive postop stress test 36.7%	
Yamada [213] Retrospective case control Level 4	2001	occult SUI n = 10	suburethral sling	51.2 (24-72)	subjective SUI : 10%	De novo urge symptom: 10%
		negative stress test with reduction n = 10	no anti-incontinence procedure	57.6 (27-70)	subjective SUI: 0	De novo urge symptom: 0
Gordon [214] Prospective Level 3	2001	Occult SUI	TVT	14,25 +/-3.08 m. (12-24)	Subjective SUI : 0% objective SUI : 10%	De novo detrusor instability (without obstruction): 13,33%
Barnes [215] retrospect. (charts review) Level 4	2002	Occult SUI n= 38	Pubovaginal sling	15 m. (6-39)	SUI : 5%	De novo urge incontinence : 9,5% 0 permanent retention
De Tayrac [216] retrospective case control Level 4	2004	Overt SUI n = 29	TVT n = 15	17.3 +/-11.4 (7-36)	SUI: 6.7%	NB: POP repair included ant mesh repair in all patients
			No additional incontinence procedure n = 14	24.1+/-6.7 (13-41)	SUI : 35.7%	
		Occult SUI n= 19	TVT n = 11	17.3 +/-11.4 (7-36)	SUI : 0%*	
			no additional anti-incontinence procedure n = 8	24.1+/-6.7 (13-41)	SUI : 12.5%* * NS	
Groutz [217] Prospective cohorte study Level 3	2004	Occult SUI n= 100	TVT	27 m. (12-52)	Symptomatic SUI urodynamically confirmed 1 year follow-up : 2%	De novo urge incontinence : 8%
Meschia [205] prospective randomized Level 1	2004	Occult SUI	TVT	26 m.	Subjective SUI: 4% objective SUI: 8%	De novo urge incontinence 12%
			plicature	24 m	subjective SUI: 36% objective SUI: 44%	De novo urge incontinence 4%

Table 13. SUI prevention at the time of vaginal surgery biologic grafts (continued)

Author / year type of trial level of evidence	Year	SUI type	Surgery + Follow up	Follow-up	SUI outcome	Comments
Liang [218] Prospective case_control Level 2	2004	Occult SUI (positive pessary test) n = 49	TVT n = 32		objective SUI : 0% subjective SUI: 9,4%	Idiopathic detrusor overactivity 16%
			No TVT n = 17		objective SUI : 52,9% subjective SUI: 64,7%	Idiopathic detrusor overactivity 5,9%
		No masked SUI (negative pessary test n= 30)	No TVT n= 30		no post-op SUI	Idiopathic detrusor overactivity 0%
Clemons [219] retrospective Level 4	2005	occult SUI n = 64	Suburethral sling grade 3-4 anterior prolapse n = 39	22.5 m	SUI: 13%*	De novo or worsening urge incontinence: 8%
			Suburethral sling grade 3-4 posterior/apical prolapse n = 25	13.6	SUI : 0%* * NS	De novo or worsening urge incontinence: 4%
Reena [200] prospective cohorte study Level 3	2007	Occult SUI (pessary during provocative exercises) n = 53	No procedure	6 w	Objective SUI: 34 (64.2%)	19 patients remained continent after surgery
Brubaker [14]	2008	Multicenter prospective randomized Level 1 322 patients enrolled all initially screened-negative for SUI	Burch group N = 157	Symptoms SUI: 19.7% (30) Positive stress test without reduction: 2% (3) with POP reduction: 35.7% (55) Detrusor overactivity: 12.1% (19)	2 yrs	Composite SUI outcome: 32.0% (Symptoms: 25.9% Stress test: 9.5%)
			Control group N = 165	Subjective SUI: 18.8% (30) Positive stress test without reduction: 5.7% (9) With reduction: 35.8% (58) Detrusor overactivity: 10.4% (17)	2 years	Composite SUI outcome: 45.2% (Symptoms: 40.6% Stress test: 6.7%)

Table 13. SUI prevention at the time of vaginal surgery biologic grafts (continued)

Author / year type of trial level of evidence	Year	SUI type	Surgery + Follow up	Follow-up	SUI outcome	Comments
Costantini [204]	2007	Single site, prospective randomized Level 2	Burch group N = 34	Negative stress test before and after reduction No symptoms of UI (history, questionnaire) No leakage during UDS	42+/- 18 mos (12-74)	De novo SUI: 26.4%
			Control group N = 32		38+/-19 mos (15-71)	De novo SUI: 3.1%
Misraï [220] Laparoscopic sacral colpopexy	2008	Retrospective case series Level 4	No SUI procedure	Negative stress test	20.4 mos.	De novo SUI: 13%

w = week m= month y= year SUI= stress urinary incontinence colposusp= colposuspension TVT= tension free vaginal tape ranscut= transcutaneous

Table 14. Concomitant Continence Procedure at Time of Colpocleisis

	Bothersome SUI three months after surgery (n=68)			Bothersome SUI 1 year after surgery (n=64)	
Underwent concomitant incontinence surgery		Yes	No	Yes	No
	Yes	8 (21%)	31 (79%)	6 (17%)	30 (83%)
	No	8 (28%)	21 (72%)	6 (21%)	22 (79%)

concomitant clinical consideration, such as a pelvic mass or extensive abdominal mesh from prior hernia repair alters the risk/benefit for certain surgical routes. There is insufficient evidence to guide the route of prolapse surgery for women with known intra-abdominal adhesions. Some surgeons may seek to avoid adhesions using an extraperitoneal approach from the vagina, while others may prefer to manage the adhesions through an incision. A shortened vagina with dyspareunia may dictate procedures that have the potential to improve vaginal depth. In one retrospective cohort study, Hilger found that almost 50% of elderly women who underwent successful abdominal repair of POP did not resume sexual activities, despite the fact that the abdominal repair was selected to preserve coital function [95].

In summary, individual risks factors should be weighed against the perceived risk of recurrence in any one individual woman in order to select the most favorable risk/benefit ratio for their specific support defects.

V. THE ROLE OF AUGMENTING MATERIALS IN POP SURGERY

The use of material is inherent in the performance of abdominal sacrocolpopexy. However, there is increasing interest in the potential role of augmenting materials to enhance POP surgery outcomes with other POP procedures, including vaginal surgery. The Cochrane review of surgically managed POP in 2007 concluded that there were insufficient data about mesh and biological graft augmentation of vaginal repairs, and stressed the need for adequately powered randomized controlled clinical trials [27]. Despite recent results from three recent RCTs [227] addressing the anterior wall and demonstrating the utility of mesh augmentation for that indication, the committee considered the current levels of uncertainty about clinical care scenarios, especially in primary prolapse repairs completed with mesh. Although a prolapse persistence or recurrence is an undesirable outcome, a secondary prolapse procedure has a good likelihood of success, especially when sacrocolpopexy is used. The clinical scenarios for subsequent procedures following failed mesh procedures are highly anecdotal. There is insufficient information about risks and efficacy of secondary procedures following primary mesh repairs.

1. AUGMENTATION FOR ANTERIOR WALL SURGERY

• *Synthetic material*

In line with our surgical colleagues there has been a move towards the use of prosthesis to augment the native tissue repair in reconstructive gynaecology. Given the relatively high failure rate of the anterior vaginal compartment at prolapse surgery it is likely that anterior vaginal wall repair would benefit most from the use of prosthesis.

The majority of Level 1 and 2 evidence [140, 228] suggest that the use of absorbable synthetic mesh overlay offers a superior anatomical outcome for anterior wall prolapse as compared to anterior colporrhaphy alone, although the evidence is divided based on relatively few women [139].

Synthetic mesh was used by Julian et al who described his prospective case control study in women who had undergone at least 2 previous vaginal repair [228]. These women had an overlay of Marlex mesh to the anterior colporrhaphy reduced the recurrence rate of cystocele from 33% to 0%, but the mesh erosion rate was 25%. Flood et al in a retrospective review of 142 women with Marlex mesh augmentation of anterior colporrhaphy demonstrated a 100 % success rate for cystoceles at 3.2 years and a mesh erosion rate of 2% [229].

Weber et al [139] in a randomized control trial compared the anterior colporrhaphy [33], ultra-wide anterior colporrhaphy [24] or anterior colporrhaphy with absorbable polyglactin (Vicryl) 910 mesh [26] in the management of cystoceles. The study size was too small to detect small differences (or no differences) in efficacy or adverse events. However, at a mean follow-up of nearly 2 years the groups had similar proportions of women experiencing satisfactory or optimal anatomic results, 30%, 46% and 42% respectively.

Sand et al [140] in a larger RCT randomonly allocated cystoceles to anterior colporraphy alone (n=70) and to anterior colporraphy plus polyglactin mesh underlay (n=73). At I year the success rate in the mesh group was 75% and significantly greater than the 57% success rate in the anterior repair group alone (P=0.02). Concurrent paravaginal defect were present in 11 women and concomitant paravaginal repair was significantly associated with a lower recurrence of cystocele overall (P=0.02). In a separate study multivariate logistic regression demonstrated concurrent pubovaginal slings for stress urinary incontinence, to be associated with significantly fewer recurrent cystoceles (odds ratio, 0.32; p=0.005) [221].

A variety of polypropylene mesh overlays have been evaluated in case series for the management of anterior wall prolapse. The anatomical success rate varies from 76 to 100% [230-235]. Salvatore et al reported worrying functional outcomes after a prolene mesh overlay including a mesh erosion rate of 13%, overactive bladder increasing from 28 to 56% and dyspareunia increasing from 18 to 38% postoperatively [236]. Visco et al suggested that the mesh erosion or infection rate was increased four-fold when mesh was

introduced vaginally as compared to the abdominal route [98]. More recently three year follow-up after the polypropylene mesh overlay in the anterior compartment has been reported. Cervigni reported on 218 women at over 3 year review with a 76% objective success rate. Mesh erosions were identified in 12.3% and vaginal stenosis in 7.7% [230]. De Tayrac reported on 55 women at 3-year review with a 89% success rate, 9.1% mesh erosions, 5.5% mesh shrinkage and 16.7% dyspareunia [237] He concluded that lower weight and coated meshes were required to limit the rate of complications and duly reported on 132 women, 12 months following low weight coated polypropylene mesh with a 92% success rate [238]. Unfortunately local problems remained with mesh erosions in 6.3% and de novo dyspareunia in 12.8%.

Two randomised control trials have been published comparing overlaying polyprolene mesh and traditional anterior colporrhaphy. Hiltunen et al compared 104 women undergoing anterior compartment prolapse repair with 6x11cm low weight monofilament polypropylene (Parietene light, Sofradim Co, Trevoux, France) with 97 undergoing traditional anterior colporrhaphy [206]. At 12 months the objective success (stage 0 or 1 Aa and Ba) rate was 93 in the mesh group and 61% in no mesh group (P<.001). Symptomatic anterior compartment prolapse was significantly lower at 4% in the mesh group as compared to 15% in the no mesh group (p<0.05). Mesh erosions were seen in 17.3%. Sivaslioglu et al reported on 43 undergoing low weight polyprolpylene mesh as compared to 42 undergoing site-specific vicryl repair and at 12 months found the objective success rate (leading edge of cystocoele was <?1 cm in relation to hymen (stage 1) was significantly higher at 91% in the mesh group and 72% in the non-mesh group [239]. The mesh erosion rate was 6.9% and de novo dyspareunia was reported in 4.6% in the mesh group and none in the non-mesh group. Quality of life assessment demonstrated no difference in outcomes between the groups and no patient in either group underwent further surgery for anterior compartment prolapse.

Since 2004, a variety of kit transobturator armed polypropylene meshes have been available. A recent RCT compared anterior polypropylene mesh (n=38) with anterior colporrhaphy. At 1 year the objective success rate (defined as less than POP-q stage II anterior vaginal prolapse) was higher in the mesh group (89% vs. 55%). Functional outcomes including quality of life, sexual activity and dyspareunia were similar in both groups with a 5% mesh erosion and 2% unilateral leg pain that settled by 8 weeks after the surgery in the mesh group [240].

Fatton et al reported on 106 women three months following vaginal mesh polypropylene mesh (anterior, posterior or total) with a 95% success rate and 4.7% mesh erosion rate in short term followup [241]. Concomitant hysterectomy was not performed and the authors felt surgeon experience was important in minimizing mesh erosion, a view that was supported by Dwyer and Orielly who reported a decreasing rate of mesh complications with increasing surgeon experience [242].

Gauruden –Burmester reported on mesh contracture rate by performing postoperative introital ultrasound measurements and revealed the vaginal polypropylene anterior mesh contracted from 7.5cm to 3.5cm (54%) and 11.5cm to 6.4cm (46%). While the mesh contracture was significant the authors found the mesh contraction was not associated with post-operative vaginal length measurements [197].

Majority Level 1 evidence suggests that polyprolene mesh overlay has a superior anatomical outcome as compared to traditional anterior colporrhaphy. These findings need to be tempered with Level 2 and 3 evidence suggesting that significant functional complications are associated with the employment of non-absorbable meshes at the time vaginal reconstructive surgery [98, 228, 236].

The consequences of these complications are not insignificant and may result in multiple subsequent surgical procedures and residual symptoms. There is a lack of evidence on the optimal management of such mesh-provoked complications. A single RCT demonstrated an armed polypropylene mesh kit had a superior anatomical outcome at one year compared to anterior colporrhaphy. This study is significantly underpowered to adequately assess functional outcomes [240]. There remains a significant paucity of data available on efficacy of the commercially available kit armed polypropelene meshes for anterior compartment prolapse. A single well designed RCT and level 2 evidence suggest the porcine dermis graft overlay to be more effective than Anterior colporrhaphy alone. A significant body of Level 2 and 3 evidence has not been able to reproduce these results. A single RCT and level 3 evidence suggest little benefit is be derived from cadaveric fascia lata or dermis as a graft material.

2. BIOLOGIC GRAFTS

Alternatively to synthetic prosthetic grafts autologous material may have a lower risk of host rejection or infection. Cosson [243] described an autologous 6-8cm long and 4 cm wide vaginal patch suspended from the tendinous archs of the pelvic fascia and tucked under the anterior repair. The success rate (<grade 1 POP) was 93% at a mean follow-up of 16 months.

Allografts from postmortem tissue banks have been used for many years in orthopedic surgery and decrease the risk associated with harvesting autologous rectus sheath or fascia lata. Cadaveric fascia lata with or without pubovaginal sling has been utilised to correct anterior compartment prolapse with a success rate varying from 81-100% with acceptable

complication rates [244-247]. Gandhi et al have reported preliminary results of a randomized control trial comparing anterior colporrhaphy alone and augmented with fascia lata graft for cystoceles [221]. At 1 year they were not able to demonstrate that the addition of the fascial lata graft improved outcomes with the success rate after anterior colporrhaphy alone being 71% as compared to 82% in those augmented with the fascia lata graft (P=0.07). No complications were reported. Cadaveric dermis has been employed as a graft material in the anterior compartment with success rates varying from 42-84% at 2 years [248-250]. Concerns regarding prion transmission causing infectious diseases [251] or residual antigenicity [252] that may cause host graft reactions have encouraged the use of porcine or bovine xenografts.

Leboeuf et al retrospectively reviewed 24 women with native tissue four corner defect repair (FDR) and 19 FDR [253]. At 15 months the success rate was 100% in the FDR group and reduced to 84% if Pelvicol overlay was utilized. Wheeler et al reported on 36 women who all underwent high uterosacral vault suspension with anterior repair augmented with porcine dermis and at 17 months found a 50% recurrence rate [254]. The authors highlighted that despite the high objective failure rate greater that 90% of the women were satisfied or somewhat satisfied with the repair and 83% would undergo the surgery again. Handel et al retrospectively compared anterior colporrhaphy (n=18), porcine dermis (n=56) and polypropelene graft (n=24) in those with cystocele [255]. The success rate at 13 months was 94%, 64% and 96% respectively with a 21% rate of vaginal extrusion of the porcine dermis graft. Alternatively to these relatively disappointing results, a number of groups have reported satisfactory objective results utilizing the porcine dermis. Gomelsky et al found in 70 women after 2 years, an 87% success rate with no complications [256]. Simsiman et al also after 2-year review of 89 women reported a 78% success rate with a 17% rate of graft erosions [257]. Meschia et al in a multicentre randomised clinical trial comparing the anterior colporrhaphy (n=103) and anterior colporrhaphy-augmented with 4x7cm piece of porcine dermis [258]. The success rate at 1 year was 93% in the anterior colporrhaphy with porcine graft overlay group as compared to 81% in anterior colporrhaphy alone group (P<0.001) with a 1% rate of graft erosion.

Tables 15, 16 and 17 summarize studies using augmenting materials for various transvaginal procedures.

In 83 women who underwent transperineal rectocele repair using polyglycolic acid mesh, Leventoglu et al reported an 89% anatomical cure rate at 14 months as well as improvement in functional outcomes for splinting, straining, and incomplete evacuation of bowel (p value =0.0001) [274].

Biological grafts do not appear to enhance to results of traditional posterior colporrhaphy. Pariaso, et al reported the results of a randomized trial in which 3 groups of women were allocated to posterior colporraphy, site-specific defect repair or biograft augmentation with xenograft and followed over 17 months [174]. Women with graft augmentation had the highest anatomic failure rate (46%) compared to PCR and SSDR group (14% and 22% respectively). The functional outcomes in all the 3 groups were similar. Similarly, in the prospective cohort study by Altman, et al, augmentation with the porcine collagen in 23 patients resulted in a recurrence rate of 41% at 38 months [271] without major materials-related complications.

Several case series demonstrate that the surgical therapeutic ratio of augmentation with synthetic material is not favourable. Case series report that synthetic grafts are associated with high anatomical success rates at the cost of complications and sequelae. De Tayrac and colleagues reported an anatomical cure rate of 92% at two-years following a combined sacrospinous suspension with polypropylene mesh posterior repair. In this case series of 26 women, one patient developed denovo dyspareunia and 3 developed vaginal erosion [237]. In the French multicenter case series reported by de Tayrac et al, investigators evaluated 76 women who underwent posterior repair using low-weight polypropylene mesh coated with absorbable hydrophilic film [238]. At a median follow-up of 10 months, they reported a 2.6% recurrence rate, 12% denovo dyspareunia rate and 6.3% vaginal mesh erosion rate.

A retrospective case series of 50 women with mesh placement in the posterior compartment (with or without anterior placement) was reported by Dwyer et al. [242]. Despite no recurrences, at a mean follow-up of 29 months, he reported 6 mesh erosions (12%), 1 denovo dyspareunia and one rectovaginal fistula. Similarly, Lim et al reported a 30% rate of vaginal erosion, 27% denovo dyspareunia rate as well as a 22% recurrence rate 35 months after posterior repair augmented with composite polyglactin 910-polypropylene mesh [268]. Milani et al augmented the midline fascial plication for rectocele repair with polypropylene mesh in 31 women. After the median follow-up of 17 months the anatomical success rate was 94% but the rate of dyspareunia in this group increased from 6% to 69% (p= <0.05) and the mesh erosion rate was 6.5% with one pelvic abscess [269].

Gauruder-Burmester et al evaluated 48 subjects with posterior wall defects in their study with a polypropylene mesh kit. At the end of one year follow-up reported good outcomes with an anatomical success at posterior vaginal wall as 100%, cure of dyspareunia postoperatively and no mesh erosions in the posterior compartment [197]. In the case series by Fatton et al, evaluating a polypropylene mesh kit,

Table 15. Augmenting Materials for Anterior Vaginal (continued)

Author	Year	Type	No	Review Months	Success Rate	Complications
SYNTHETIC MESH						
Julian (228)	1996	Marlex Control	12 12	24	100% 66%	25% mesh erosion, infection
Nicita (234)	1998	Prolene	44	14	100%	3 uterine prolapse
Flood (229)	1998	Marlex	142	38	100%	3 mesh erosions
Migliari (232)	1999	Mixed fiber	15	23	93%	
Migliari(231)	2000	Polypropylene	12	20	75%	
Natale (233)	2000	Polypropylene	138	19	97%	13 mesh erosions, 9 dyspareunia, 1 haematoma
Sand (140)	2001	Polyglactin No mesh	73 70	12	75% 57%	no mesh complications
Weber (139)	2001	Polyglactin No mesh	26 57	23 23	42% 37%	no mesh complications
Salvatore (236)	2002	Prolene	32	17	87%	13% mesh erosions
O'Reilly (235)	2003	Polypropylene Atrium	81	28	88%	no mesh erosions
Cervigini (230)	2007	Polypropylene	218	38	76%	12.3% erosions 7% Vaginal stenosis
Jo(259)	2007	Polypropylene Gynemesh	38	18	94%	0 erosions
Rodriguez (260)	2005	Polypropylene	98		85%	0 erosions
Amrute (261)	2007	Polypropylene	76	30	95%	3% erosions
de Tayrac(262)	2005	Polypropylene	84	24	92%	8.3%
de Tayrac(263)	2006	Polypropylene	55	37	89.1%	9.1% mesh erosion 5.5% mesh shrinkage 16.7% dyspareunia 10% dyspareunia
de Tayrac(237)	2006	Polypropylene	48	18	98%	8.3% erosions
de Tayrac(238)	2007	low weight Polypropylene coated	32	13	93%	6.3% erosion 12.8% de novo dyspareunia
Hiltunen (206)	2007	RCT low weight Polypropylene AC	104 97	12 12	93% 62%	17.3% erosions 4 TVT 1 vault prolapse 5 TVT 1 ant mesh
Sivaslioglu (239)	2007	RCT low weight Polypropylene Site specific vicryl AC 42	43 42	12 12	91% 72%	6.9% mesh erosions 4.6% de novo dyspareunia dyspareunia

Table 15. Augmenting Materials for Anterior Vaginal (continued)

Author	Year	Type	No	Review Months	Success Rate	Complications
Nguyen (240)	2008	RCT Armed Polypropylene Perigee AC	38 38	12 12	89% 55%	5% Erosion 9%dyspareunia 16% dysparuenia
Altman (264)	2007	Polypropylene Prolift	123	2	87%	1.5% mesh Erosions 3.2% organ perforation
Biological Grafts						
Allographs:						
Cosson (243)	2001	Autologous Vaginal patch	47	16 months	93%	none
Groutz (245)	2001	cadaveric & pubovaginal sling	19	20	100%	none
Kobashi (265)	2002	cadaveric fascia lata & sling	132	12	87%	1 osteitis pubis
Chung (248)	2002	cadaveric dermis	19	24	84%	1 infection removal
Clemons(249)	2003	cadaveric dermis	33	18	59%	1 incision breakdown
Powell (247)	2004	cadaveric fascia lata	58	24	81%	10% graft erosion 2 transfusions, 1 cystotomy 3 ureteral kinking
Frederick (244)	2005	cadaveric fascia lata & sling	251	6	93%	1 osteitis pubis
Gandhi(221)	2005	RCT AC & fascia lata (Tutoplasta) AC no graft	76 78	13 13	82% 71%	no graft comlications
Ward (250)	2007	cadaveric dermis	39	24	42%	1 *de novo* dyspareunia No graft erosions
Xenographs						
Lebouf (253)	2004	FDR & Pelvicol PDR	9 24	15 15	84% 100%	None None
Salomon (266)	2004	porcine dermis transobturator	27	14	81%	1 graft r/o vaginal pain
Gomelsky (256)	2004	porcine dermis	70	24	87%	none
Wheeler (254)	2006	porcine dermis Uterosacral repair	28	18	50%	2% granulation tissue
Meschia (258)RCT	2007	Porcine AC	98 103	12 12	93% 81%	1% vaginal extrusion
Handel (255)	2007	Porcine dermis Polypropylene AC	56 25 18	13 13 13	64% 96% 94%	21% vaginal extrusions 4% mesh erosion
Simsiman (256)	2006	Porcine graft	89	24	78%	17% erosions
Robles (267)	2007	Porcine dermis Polypropylene arm	90	8	85%	no complications

Variable definitions of success used.

Table 16. Augmenting Materials for the Posterior Vagina

SYNTHETIC MESH					
Author	**Graft**	**N**	**Follow-up**	**Succes %**	**Complications**
Permanent					
Altman D [264]	Polypropylene	91	6 months	91%	Rectal perforation N=4 Wound infection N=1
De Tayrac [237]	Polypropylene	26	22 months	92%	Vaginal erosion N=3
De Tayrac [238]	Polypropylene	76	10 months	72%	Vaginal erosion 6.3% *De novo* dyspareunia 13%
Dwyer P [242]	Poypropylene	50	29 months	100%	Rectovaginal fistula N=1
Fatton B [241]	Polypropylene	28 (isolated) 58 ant and posterior	25 weeks	86.2% 98.3%	
Gauruder-Burmester A [197]	Polypropylene	48	12 months	100%	
Lim Y [268]	Prolene-vicryl	37	35 months	78%	Mesh erosion N=11
Milani [269]	Polypropylene	31	17 months	94%	Mesh erosion 6.5%
Parker MC [270]	Polypropylene	4	14 months	75%	
Absorbable					
Sand P [140]	Polyglycolic acid No mesh	67 65	?One yr.	90% 91%	No mesh erosion
BIOLOGIC GRAFTS					
Author	Graft	N	Follow-up	Succes %	Complications
Altman D [271]	Porcine Dermis	23	3 years	69&	None
Ghoniem G [272]	Allograft	91	2.6 years	97.6%	Vaginal hematoma N=1
Kobashi K [246]	Cadaveric Fascia	73	13 months	90%	Dyspareunia 23% Granulation tissue 11%
Kohli N [273]	Porcine Dermis	30	12 months	93%	None
Paraiso M [174]	Porcine Dermis Site Specific Posterior Colpo.	31 37 37	17 months	54% 78% 86%	None

Table 17. Mesh kits used for apical repairs

Author	**Year**	**Type**	**No.**	**Followup** weeks	Success rate	complications
Abdel Fattah [275]	2008	Apogee American Medical Systems	38	12	95% (36/38)	Blood loss>400mls 1 UTI 1 Dyspareunia 1 Rectal injury 1 Vag erosion 4
Gaurder-Burmester [197]	2007	Apogee American Medical Systems	48	52	100%	
Fatton [241]	2007	Prolift, Johnson & Johnson, Ethicon	88	25	93%	2 haematoma
Belot F [196]	2005	Prolift Johnson & Johnson, Ethicon	277	Not stated	Not stated	Erosion 34/277
Abdel Fattah [275]	2008	Prolift Johnson & Johnson, Ethicon	143	12	94%	1rectal injury 1 bladder injury 1 Transfusion 14 buttock pain 7 dyspareunia 16Vag.erosion 1 bladder erosion
Biertho [276]	2007	PIVS Tyco Helathcare, USA	34	12	91	1erosion 1 haemorrhage
Foote [277]	2007	PIVS Tyco Helathcare, USA	52	20	83%	Erosion 11/52
Matox [278]	2006	PIVS Tyco Helathcare, USA	21	7	37%	1 proctotomy 1 hemotoma
Vardy [279] [280]	2006 2005	PIVS Tyco Helathcare, USA	98	3	99%	2 erosion
Neuman [194]	2007	PIVS Tyco Helathcare, USA	140	120	99%	12 erosions
de Tayrac [238]	2007	PIVS Tyco Helathcare, USA	21	42	95%	2 hemotoma
Amrute [261]	2007	Polypropelene H shaped	76	123	95%	2 erosion 2 dyspareunia

58 women with rectocele underwent posterior mesh repir. At the short-term follow-up at 3 months, there were two cases of Stage 2 prolapse of the posterior vaginal wall and there were five patients with mesh exposure [241].

Altman, et al, reported a 91% posterior anatomical cure rate in their interim analysis at 2 months following polypropylene mesh repair. The same authors evaluating the perioperative morbidity with this technique at the 6-month follow-up reported four cases of rectal perforation and one wound infection [264].

A variety of kits have been proposed for repair of prolapse that includes apical support loss. Routine use of these kits should be regarded cautiously based on the complications reported in the series in **Table 17.**

VI. RECTAL PROLAPSE

External rectal prolapse is a circumferential, full-thickness protrusion of the rectum through the anus. This section is limited to a discussion of surgically treatment for external rectal prolapse and does not discuss internal rectal prolapse or various forms of intrasuccesption. More than 90% of patients with rectal prolapse are women [281] and the incidence peaks in women older than 70 years old [282] Pelvic organ prolapse and rectal prolapse may occur concurrently. In a recent study, 48% of patients treated for rectal prolapse developed genital prolapse at some point of time [283]. Patients with rectal prolapse have debilitating symptoms and they usually therefore require surgical intervention. There are some 100 different surgical methods described for surgical correction of rectal prolapse, but there are no randomized, well powered, studies to base clinical decision making on. Available randomized studies have major methodological limitations.

Surgical treatment of complete rectal prolapse includes has traditionally been divided into perineal and transabdominal approaches. Perineal procedures include complete (the “Altemeier procedure”), or partial resection (the “Delorme procedure”) of the prolapse. Transabdominal procedures can be performed either with open or laparoscopic techniques and include different types of suspension and sometimes concomitant bowel resection. Mobilization of the rectum down is an integral part of correction of the prolapse. The extent of mobilization varies and there are some data suggesting that the lateral ligaments should be preserved. A recently introduced surgical technique, laparoscopic ventral rectopexy, avoids posterior rectal mobilization and has been found to have low rate of postoperative constipation in initial studies. These results need to be confirmed in larger trials, with longer follow-up, at other institutions.

Concomitant sigmoid resection is frequently used in patients with preoperative constipation symptoms and there are some data that this addition may slightly decrease the risk for postoperative constipation.

There are few randomized studies evaluating surgical treatment for rectal prolapse. In 2000, Bachoo et al. performed a review for the Cochrane collaboration evaluating all randomized or quasi-randomized trials of surgery for rectal prolapse [284]. Ten trials were included with a total of 324 participants and the studies had varying aims. The small sample size of included trials, together with methodological weaknesses, limited the review and the authors suggested larger and better designed trials to define the optimal treatment for rectal prolapse.

The Association of Coloproctology of Great Britain and Ireland initiated a randomized multicenter trial, the PROSPER (Prolapse Surgery: Perineal or Rectopexy) trial, in 2000 which is currently recruiting.

1. PERINEAL PROCEDURES

Perineal procedures offer less surgical trauma, but are associated with higher recurrence rates and therefore usually reserved to old or frail patients. The two most common perineal procedures for rectal prolapse are the Delorme procedure and the Altemeier procedure. In several studies the recurrence rate is stated to be approximately 20% for both these procedures. However, recurrence rates tend to increase with the follow-up time in the studies and it is conceivable that the recurrence rate is significantly higher in fit patients. There are no prospective randomized studies comparing the recurrence rates between these procedures. The Delorme procedure has been the more popular in Western Europe, while the Altemeier procedure has been the dominating perineal procedure in North America.

Agachan et al. compared the outcome after the Delorme procedureand the Altemeir procedure with or without concomitant levatorplasty [285]. The recurrence rate was highest after the Delorme procedure (38%) and lowest after the Altemier procedure including a concomitant levatorpalsty (5%).

a) The Delorme procedure

The Delorme procedure was first described in 1900 by the French military surgeon Edmond Delorme [286]. The procedure includes stripping of the mucosa of the prolapsed rectum and suture plication of the remnant rectal wall.

There are several studies on the outcome after the Delorme procedure and results vary between studies [287-291]. The vast majority of studies are retrospective and there are no prospective randomized studies published comparing the results with other surgical techniques. In a recent retrospective study, Marchal et al. [288] reported a complication rate of 15%

and a recurrence rate of 23% in 60 patients undergoing the Delorme procedure. The authors compared the Delorme group of patients with a group of patients undergoing the Orr-Loygue rectopexy and found that the Delorme procedure had a higher recurrence rate. After the Delorme procedure, patients with preoperative constipation had this symptom improved or completely resolved in 54% and worsened in 12% postoperatively. 42% of patients with preoperative incontinence were continent or had continence improvement postoperatively.

b) The Altemeier procedure

Perineal rectosigmoidectomy for rectal prolapse was tried in a few patients in the late 19th century, but it was not until 1952 the procedure was popularized by Altemeier [292]. The prolapsed bowel is transected 2-4cm proximal to the dentate line and the level should not include the internal or external anal sphincters. The inner tube of the rectum is then mobilized until there is some resistance to achieve more mobilization. The vessels to the rectal mesentery are ligated or transected using the ultracision equipment. The inner tube of the rectum is transected and sutured to the outer tube with an anastomosis. Some surgeons add a levatorplasty, to decrease the size of the levator hiatus, before suturing the anastomosis. Some surgeons use a stapled technique to achieve the anastomosis.

There are several studies on the outcome after the Delorme procedure and results vary between studies [282, 293-296]. The vast majority of studies are retrospective. There is one randomized study comparing perineal rectosigmoidectomy with pelvic floor repair with abdominal resection rectopexy and pelvic floor repair [297]. The study included ten patients in each group and only one patient had a recurrence. There were no significant differences in functional outcomes.

In a recent retrospective study, Kim et al. reported a complication rate of 14% and a recurrence rate of 16% in 60 patients undergoing the Delorme procedure [294]. Functional improvement was not significantly different, and most patients were satisfied with treatment and outcome.

2. TRANSABDOMINAL PROCEDURES

Transabdominal procedures can be performed either with open or laparoscopic techniques and they include different types of suspension and sometimes concomitant bowel resection. Laparoscopic rectopexy is reported to offer the same or better outcome as after open rectopexy [298-305]. There are two small (21 and 40 patients respectively) randomized studies, with 21 and 40 patients respectively in the literature comparing laparoscopic mesh rectopexy with open mesh rectopex [299, 306]. Recurrence rates were quite small after both types of procedures and there were no significant differences in functional outcome. Transabdominal procedures result in general in low recurrence rates [307-309] and the discussion regarding outcomes is therefore focused on functional outcome. As discussed above, some patients may develop worsened constipation postoperatively and not all patients regain normal continence. The mobilization of the rectum at transabdominal procedures can be of varying degrees. The effect of lateral ligament division was assessed in one small randomized study involving 26 patients [310]. The study demonstrated a trend for higher recurrence rate after preservation of the lateral ligaments, while this preservation seemed to decrease the risk for postoperative constipation. A recently introduced technique (laparoscopic ventral rectopexy) provides rectal prolapse repair without any significant rectal mobilization [311]. In the first initial reports, the authors have reported excellent postoperative outcome [311, 312]; however there is no high-quality evidence to recommend this procedure.

a) Rectopexy

The dominating transabdominal technique for the treatment of rectal prolapse in recent decades has been rectopexy. The surgical procedure, open or laparoscopic, begins with mobilization of the rectum. The extent of dissection varies in different series, but most surgeons tend to mobilize the rectum down to the coccyx posteriorly, preserve the lateral ligaments laterally. The extent of anterior dissection varies, from none to mobilization of 2-4 centimeters of the rectovaginal septum.

The choice of fixation method varies in different reports [172, 294, 309, 313, 314]. The fixation can be achieved with different mesh materials fixated usually posteriorly, but sometimes laterally or anteriorly. Suture rectopexy is frequently used and the mesorectum is then fixated to the sacrum with a few sutures. There are few studies comparing different fixation methods or materials in the same report. Novell et al compared the use of Ivalon sponge with suture rectopexy in one randomized trial involving 63 patients [315]. The recurrence rates were the same (one in each group) and functional outcome was not significantly different. Two other randomized trials compared the outcome after different types of mesh. Galili et al. [316] compared polyglycolic acid mesh with polypropylene mesh and Winde et al [317] compared polyglycolic acid mesh with polyglactin mesh. Sample sizes were limited (37 and 49 patients respectively) and no significant differences in recurrence rates or functional outcome were detected. As there has not been possible to detect any difference in outcomes between different fixations methods, some authors argue that suture rectopexy may be preferable as this method does not carry an associated risk for mesh complications [309].

The combination of rectopexy and concomitant sigmoid resection (the “Frykman-Goldberg operation”) is frequently used to decrease the risk for postoperative

constipation problems. Several studies have evaluated postoperative constipation symptoms after resection rectopexy [318, 319]. Benoist et al. compared results after laparoscopic suture rectopexy with (n = 18) or without sigmoid resection (n = 16) (298). Postoperative constipation was observed in 2 patients (11%) after resection rectopexy and in 10 (62%) after suture rectopexy ($P < 0.01$). Two small randomized studies have evaluated the effect of concomitant sigmoid resection on constipation after rectopexy. McKee et al. prospectively randomized 18 patients to rectopexy alone or rectopexy combined with concomitant sigmoid resection [320]. Three months postoperatively, 7 patients after rectopexy alone and 2 patients after concomitant sigmoid resection complained of severe constipation. Luukkonen et al. prospectively randomized 15 patients to rectopexy and sigmoid resection or rectopexy without resection [321]. The authors found a lower risk for postoperative constipation in the patients who underwent concomitant sigmoid resection.

Orr-Loygue rectopexy includes mobilization of the rectum and fixing the rectum with two strips of synthetic mesh from the anterolateral sides of the distal rectum to the sacral promontory [322]. In a recent prospective study, Douard et al. evaluated 31 consecutive patients operated with this technique [323]. They reported no recurrences after a mean follow-up of 28 months. Patients with incontinence decreased from 81% preoperatively to 55% postoperatively and continence improved in 96% of patients. Evacuation difficulties increased significantly after surgery, from 23% to 61% of patients. In another recent study, Marchal et al. [288] reported similar results, with a recurrence rate of 4% in 49 patients with a mean follow-up time of 88 months (Marchal, 2005). In patients with preoperative constipation, this symptom was improved or completely resolved in 33% and worsened in 58% postoperatively. In patients with preoperative incontinence, 73% were continent or had continence improvement postoperatively.

b) Laparoscopic ventral rectopexy

Laparoscopic ventral rectopexy provides rectal prolapse repair without any significant posterior rectal mobilization, which therefore decreases the risk for autonomic nerve damage [311]. The rectovaginal septum is opened and dissected. A Marlex mesh is thereafter sutured to the anterior aspect of the distal rectum and fixated proximally to the sacral promontory. No posterior mobilization of the rectum is performed.

The authors have reported recurrence rate of less than 5% after a mean follow up of 61 months and constipation resolved in 16 of 19 patients with preoperative constipation [311].

VII. RECOMMENDATIONS

The committee makes the following graded recommendations:

- **GRADE A** (usually depends on consistent level 1 evidence and often means that the recommendation is effectively mandatory and placed within a clinical care pathway.

Sacrocolpopexy is a highly recommended apical prolapse procedure.

Synthetic material is superior to biological material for sacrocolpopexy.

The use of polypropylene mesh for trans-vaginal anterior wall repair improves 1 year anatomic outcomes; this advantage should be weighed against the risk of mesh-related complications and uncertainty regarding long-term functional outcomes.

Transvaginal route is preferable to transanal route for posterior vaginal prolapse repair.

- **GRADE B** usually depends on consistent level 2 and/or 3 studies, or “majority evidence from RCTs:

A single RCT provides level 1 evidence that concomitant Burch colposuspension is recommended in women without symptoms of stress incontinence at the time of open sacrocolpopexy. There is conflicting Level 2 evidence.

Concomitant total hysterectomy at the time of mesh-augmented repairs increases mesh erosion; therefore, alternative surgical plans with reduced risks should be considered.

When hysterectomy is indicated, concomitant anterior repair without augmenting materials is reasonable.

There is no evidence to support the use of synthetic mesh for trans-vaginal repair (or augmentation of repair) in the posterior wall.

Levator ani plication during posterior colporrhaphy should rarely be used in sexually active women because of the increased risk of dyspareunia.

A single RCT provides level 1 evidence that porcine dermis without fascial repair is inferior to posterior vaginal fascial plication or site specific defect repair. This is consistent with a Level 2 cohort study.

- **GRADE C** usually depends on level 4 studies or “majority evidence’ from level 2/3 studies or Dephi processed expert opinion.

Suspension of the apex by an appropriate method should be considered at the time of each vaginal prolapse repair.

There is no evidence for the superiority of any specific technique for transvaginal apical suspension using native tissue.

Traditional fascial plication of the posterior vaginal wall has a lower anatomic failure rate than site-specific fascial defect repair.

A single level 1 study provides evidence that the use of porcine dermis as an overlay for anterior vaginal repair is superior to traditional vaginal fascial plication, although there is conflicting Level 2 and 3 data.

Trans-vaginal placement of mesh after intraoperative procotomy is discourgaged.

Trialists should report sufficient detail regarding anatomic and symptomatic outcomes so that subsequent outcome definitions can be tested in a wide variety of datasets. Primary and recurrent cases should be reported separately. Outcomes of treatments should be evaluated in multiple domains.

Laparoscopic sacrocolpopexy is used as an alternative to open sacrocolpopexy, although no comparative studies report outcomes.

Anatomic support defects without accompanying, relevant symptoms are rarely an indication for prolalpse surgery.

Evidence-based surgical alternatives should be offered to all women planning prolapse surgery.

The safety and feasibility of reoperation in the event of recurrent prolapse should be considered when performing the primary repair.

- **GRADE D =** "no recommendation possible" to be used where the evidence is inadequate or conflicting and where expert opinion is delivered without a formal analystical process, such as by Dephi.

There is insufficient information to provide evidence-based recommendations for the route of primary prolapse repair. There is level I evidence that sacrocolpopexy is more effective and durable in correcting anatomical defects, while the native tissue vaginal route is faster and less expensive to perform with a quicker return to activities of daily living. In addition, the vaginal route has fewer serious perioperative complications.

There is insufficient information to provide evidence-based recommendations for the optimal vaginal repair approach, including technique and materials.

There is insufficient information to provide an evidence-based recommendation for trans-vaginal mesh placement following intraoperative cystotomy.

The committee recommends that the following areas be prioritized for future research:

- It is essential to standardized mal method for determining outcome for POP surgery. The lack of consensus significantly impacts the ability to conduct, compare and contrast clinical research in this area.
  - Patient-reported and functional status before and after prolapse surgery.
  - Anatomic resolution (in operated and unoperated compartments) and relationship with symptoms.
- Well-designed RCT studies are needed to:
  - determine the role of hysterectomy (total or subtotal) during repair of POP with in situ uterus,
  - determine the optimal procedure for repair of post-hysterectomy POP,
  - compare native tissue vs. mesh-based apical repair techniques,
  - compare various trans-vaginal techniques for apical support,
  - compare the role of peri-operative physical therapy,
  - compare native tissue vs. mesh-based apical repair techniques,
  - determine the optimal management of stress continent women at the time of prolapse repair, by any technique, and
  - determine the optimal technique for repair of recurrence after primary mesh repair in any compartment.
- Well-designed comparative studies are needed to study
  - the utility of self-prepared mesh vs. kit-prepared mesh for apical and/or anterior prolapse repairs,
  - the safety and efficacy of prolapse-repair meshes that include arms that traverse non-vaginal spaces,
  - management of mesh complications especially mesh contracture and complications associated with armed meshes, and
  - management of recurrent anterior compartment prolapse following unsuccessful permanent mesh.
- Registeries are strongly recommended with the introduction of new devices to ensure safety and inform clinical trial planning.

There is sufficient evidence to support recommendations for some, but not all, decisions regarding the route of POP surgery. Textbooks of pelvic surgery often describe both abdominal and vaginal routes for POP procedures without commenting on the basis for selection of the route of surgery. When mentioned, most authorities state that pelvic surgeons should be proficient at procedures using both routes, and should tailor the procedure to the patient and her specific defects, decrying the "one procedure fits all" concept. However, some procedures for POP require special skills or experience, and not all surgeons will feel comfortable with all procedures. Relative indications cited for abdominal surgery include other reasons that mandate an abdominal approach, such as pelvic masses, the likelihood of dense pelvic adhesions, or the need for other extrapelvic abdominal procedures. Additional factors must include risk factors for failure, medical condition of the patient, risk of abdominal surgery in obesity or the frail elderly, and prior failed procedures for POP.

The emergence of mesh-based procedures poses a dilemma as there is significant uncertainty about the safety and efficacy of secondary prolapse procedures for prolapse recurrence following a primary mesh procedure. There are surgical concerns regarding the status of normal dissection planes, especially following a uterine-conserving mesh-based procedure. Given the high success rates of sacrocolpopexy in women with recurrent prolapse, the risk/benefit ratio of routine mesh placement for primary prolapse procedures needs further evalution. Appropriate counseling of patient must include the known serious risks of mesh placement and the uncertainty of long-term functional outcomes.

REFERENCES

1. Olsen AL, Smith VJ, Bergstrom JO, Colling JC, Clark AL. Epidemiology of surgically managed pelvic organ prolapse and urinary incontinence. Obstet Gynecol. 1997;89(4):501-6.
2. Fialkow MF, Newton KM, Lentz GM, Weiss NS. Lifetime risk of surgical management for pelvic organ prolapse or urinary incontinence. International Urogynecology Journal 2008 Mar;19(3):437-40.
3. Maher C, Baessler K, Glazener CM, Adams EJ, Hagen S. Surgical management of pelvic organ prolapse in women.[update of Cochrane Database Syst Rev. 2004;(4):CD004014; PMID: 15495076]. Cochrane Database Syst Rev. 2007(3):CD004014.
4. Jia X, Glazener CM, Mowatt G, Maclennan G, Fraser C, Burr J. Systematic review of the efficacy and safety of using mesh or grafts in surgery for anterior and/or posterior vaginal wall prolapse. reBIP report IP No 660. National Institute for Health and Clinical Excellence. London.; 2008.
5. Weber AM, Abrams P, Brubaker L, Cundiff G, Davis G, Dmochowski RR, et al. The standardization of terminology for researchers in female pelvic floor disorders. International Urogynecology Journal. 2001;12(3):178-86.
6. Swift SE. The distribution of pelvic organ support in a population of female subjects seen for routine gynecologic health care. AJOG. 2000;183(2):277-85.
7. Burrows LJ, Meyn LA, Walters MD, Weber AM. Pelvic symptoms in women with pelvic organ prolapse. Obstetrics & Gynecology. 2004 Nov;104(5 Pt 1):982-8.
8. Ghetti C, Gregory WT, Edwards SR, Otto LN, Clark AL. Pelvic organ descent and symptoms of pelvic floor disorders AJOG. 2005 July;193(1):53-7.
9. FitzGerald MP, Janz NK, Wren PA, Wei JT, Weber AM, Ghetti C, et al. Prolapse severity, symptoms and impact on quality of life among women planning sacrocolpopexy. Int J Gynecol Obstet 2007;98:24-8.
10. Jelovsek JE, Barber M. Women seeking treatment for advanced pelvic organ prolapse have decreased body image and quality of life. Am J Obstet Gynecol. 2006 May;194(5):1455-61.
11. Brubaker L, Cundiff GW, Fine P, Nygaard I, Richter HE, Visco AG, et al. Abdominal sacrocolpopexy with Burch colposuspension to reduce urinary stress incontinence. New England Journal of Medicine. 2006 Apr 13;354(15):1557-66.
12. Haessler AL, Lin LL, Ho MH, Betson LH, Bhatia NN. Reevaluating occult incontinence. Current Opinion in Obstetrics & Gynecology. 2005;17(5):535-40.
13. Burgio KL, Nygaard IE, Richter HE, Brubaker L, Gutman RE, Leng W, et al. Bladder symptoms one year after abdominal sacrocolpopexy with and without Burch colposuspension in women without preoperative stress incontinence symptoms. Am J Obstet Gynecol. 2007.
14. Brubaker L, Nygaard I, Richter HE, Visco AG, Weber A, Cundiff G, et al. Two-year outcomes after sacrocolpopexy with and without burch to prevent stress urinary incontinence: A randomized controlled trial. Obstet & Gynecol. 2008;112(1):49-55.
15. Fitzgerald MP, Kulkarni N, Fenner D. Postoperative resolution of urinary retention in patients with advanced pelvic organ prolapse. American Journal of Obstetrics & Gynecology. 2000;183(6):1361-3; discussion 3-4.
16. Handa VL, Zyczynski HM, Brubaker L, Nygaard I, Janz NK, Richter HE, et al. Sexual function before and after sacrocolpopexy for pelvic organ prolapse. American Journal of Obstetrics & Gynecology. 2007 Dec;197(6):629.e1-6.
17. Pauls RN, Silva WA, Rooney DM, Siddighi S, Kleeman SD, Dryfhout V, et al. Sexual function after vaginal surgery for pelvic organ prolapse and urinary incontinence. Am J Obstet & Gynec. 2007;197(6):Dec.
18. Bradley CS, Brown MB, Cundiff GW, Goode PS, Kenton K, Nygaard I, et al. Bowel Symptoms in Women Planning Surgery for Pelvic Organ Prolapse. Am J Obstet Gynecol. 2006;195:1814-19.
19. Jackson SL, Weber AM, Hull TL, Mitchinson AR, Walters MD. Fecal incontinence in women with urinary incontinence and pelvic organ prolapse. Obstetrics & Gynecology. 1997;89(3):423-7.
20. Meschia M, Buonaguidi A, Pifarotti P, Somigliana E, Spennacchio M, Amicarelli F. Prevalence of anal incontinence in women with symptoms of Urinary Incontinence and Genital Prolapse. Obstetrics & Gynecology 2002;100:719-23.
21. Bradley CS, Nygaard I, Brown MB, Gutman RE, Kenton K, Whitehead WE, et al. Bowel Symptoms in Women One Year after Sacrocolpopexy. Am J Obstet Gynecol. 2007;197:642e1-e8.
22. Maher CF, Qatawneh AM, Dwyer PL, Carey MP, Cornish A, Schluter PJ. Abdominal sacral colpopexy or vaginal sacrospinous colpopexy for vaginal vault prolapse: a prospective randomized study. Am J Obstet Gynecol. 2004;190(1):20-6.

23. Nygaard I, Handa VL, Brubaker L, Borello-France D, Wei JT, Wells E, et al. Physical Activity in women planning sacrocolpopexy. Int Urogyn J. 2007;18:33-7.
24. Boyles S, Weber A, Meyn L. Procedures for pelvic organ prolapse in the United States, 1979-1997. American Journal of Obstetrics and Gynecology. 2003 2003/1//;188(1):108-15.
25. 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(6):1418-21.
26. Lo TS. Tension-free vaginal tape procedures in women with stress urinary incontinence with and without co-existing genital prolapse. Curr Opin Obstet Gynecol. 2004;16(5):399-404.
27. Maher C, Baessler K, Glazener CM, Adams EJ, Hagen S. Surgical management of pelvic organ prolapse in women.[update in Cochrane Database Syst Rev. 2007;(3):CD004014; PMID: 17636742]. Cochrane Database Syst Rev. 2004(4):CD004014.
28. 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. The Continence Program for Women Research Group. American Journal of Obstetrics & Gynecology. 1996;175(2):326-33; discussion 33-5.
29. Morley GW, DeLancey JO. Sacrospinous ligament fixation for eversion of the vagina. American Journal of Obstetrics & Gynecology. 1988;158(4):872-81.
30. Rooney K, Kenton K, Mueller ER, FitzGerald MP, Brubaker L. Advanced anterior vaginal wall prolapse is highly correlated with apical prolapse. Am J Obstet Gynecol. 2006;195(6):1837-40.
31. Hsu Y, Chen L, Summers A, Ashton-Miller JA, DeLancey JO. Anterior vaginal wall length and degree of anterior compartment prolapse seen on dynamic MRI. International Urogynecology Journal. 2008 Jan;19(1):137-42.
32. Cundiff G, Varner E, Visco AG, Zyczynski H, Nager C, Norton PA, et al. Risk Factors for Mesh/Suture Erosion Following Sacrocolpopexy. Am J Obstet Gynecol, Accepted
33. Nygaard IE, McCreery R, Brubaker L, Connolly AM, Cundiff G, Weber A, et al. Abdominal sacrocolpopexy: A comprehensive review. Obstet & Gynecol. 2004;104:805-23.
34. Arthure HG. Vault suspension. Proc R Soc Med. 1949;4:388-90.
35. Falk HC. Uterine prolapse and prolapse of the vaginal vault treated by sacropexy. Obstet Gynecol 1961;18:113-5.
36. Lane FE. Repair of posthysterectomy vaginal-vault prolapse. Obstet Gynecol. 1962;20:72-7.
37. Birnbaum SJ. Rational therapy for the prolapsed vagina. Am J Obstet Gynecol. 1973;115:411-9.
38. Rust JA, Botte JM, Howlett RJ. Prolapse of the vaginal vault. Improved techniques for management of the abdominal approach or vaginal approach. Am J Obstet Gynecol. 1976;125:768-76.
39. Feldman GB, Birnbaum SJ. Sacral colpopexy for vaginal vault prolapse. Obstet Gynecol. 1979;53:399-401.
40. Cowan W, Morgan HR. Abdominal sacral colpopexy. Am J Obstet Gynecol 1980;138:348-50.
41. Symmonds RE, Williams TJ, Lee RA, Webb MJ. Posthysterectomy enterocele and vaginal vault prolapse. Am J Obest & Gynec. 1981;140(8):852-9.
42. Lansman HH. Posthysterectomy vault prolapse: sacral colpopexy with dura mater graft. Obstet Gynecol 1984;63:577-82.
43. Grundsell H, Larsson G. Operative management of vaginal vault prolapse following hysterectomy. Br J Obstet Gynaecol. 1984;91:808-111.
44. Addison WA, Livengood CH, Sutton GP, Parker RT. Abdominal sacral colpopexy with Mersilene mesh in the retroperitoneal position in the management of posthysterectomy vaginal vault prolapse and enterocele. Am J Obstet Gynecol. 1985;153:140-6.
45. Kauppila O, Punnonen R, Teisala K. Prolapse of the vagina after hysterectomy. Surg Gynecol Obstet 1985;161:9-11.
46. Kauppila O, Punnonen R, Teisala K. Operative technique for the repair of posthysterectomy vaginal prolapse. Ann Chir Gynaecol 1986;75:242-4.
47. Drutz HP, Cha LS. Massive genital and vaginal vault prolapse treated by abdominal-vaginal sacropexy with use of Marlex mesh: review of the literature. Am J Obstet Gynecol. 1987;156:387-92.
48. Angulo A, Kligman I. Retroperitoneal sacrocolpopexy for correction of prolapse of vaginal vault. Surg Gynecol Obstet 1989;169:319-23.
49. Baker KR, Beresford JM, Campbell C. Colposacropexy with Prolene mesh. Surg Gynecol Obstet 1990;171:51-4.
50. Maloney JC, Dunton CJ, Smith K. Repair of vaginal vault prolapse with abdominal sacropexy. J Reprod Med 1990;35:6-10.
51. Creighton SM, Stanton SL. The surgical management of vaginal vault prolapse. Br J Obstet Gynaecol 1991;98:1150-4.
52. Snyder TE, Krantz KE. Abdominal-retroperitoneal sacral colpopexy for the correction of vaginal prolapse. Obstet Gynecol 1991;77:944-9.
53. Imparato E, et al. Surgical management and prevention of vaginal vault prolapse. Surg Gynecol Obstet. 1992;175(3):233-7.
54. Timmons MC, Addison WA, Addison SB, Cavenar MG. Abdominal sacral colpopexy in 163 women with posthysterectomy vaginal vault prolapse and enterocele. Evolution of operative techniques. J Reprod Med 1992;37:323-7.
55. Traiman P, De Luca LA, Silva AA, Antonini R, Dias R, Rodrigues JR. Abdominal colpopexy for complete prolapse of the vagina. Int Surg. 1992;77:91-5.
56. Iosif CS. Abdominal sacral colpopexy with use of synthetic mesh. Acta Obstet Gynecol Scand. 1993;72:214-7.
57. van Lindert AC, Groenendijk AG, Scholten PC, Heintz AP. Surgical support and the suspension of genital prolapse, including preservation of the uterus, using Gore- Tex soft patch (a preliminary report). Eur J Obstet Gynecol Reprod Biol. 1993;50:133-9.
58. Grunberger W, Grunberger V, Wierrani F. Pelvic promontory fixation of the vaginal vault in sixty-two patients with prolapse after hysterectomy. JACS. 1994;178:69-72.
59. Lecuru F, Taurelle R, Clouard C, Attal JP. Surgical treatment of genito-urinary prolapses by abdominal approach. Results in a continuous series of 203 operations. Ann Chir 1994;48:1013-9.
60. Nezhat CH, Nezhat F, Nezhat C. Laparoscopic sacral colpopexy for vaginal vault prolapse. Obstet Gynecol. 1994;84:885-8.
61. Valaitis SR, Stanton SL. Sacrocolpopexy: a retrospective study of a clinician's experience. Br J Obstet Gynaecol. 1994;101:518-22.
62. Virtanen H, Hirvonen T, Makinen J, Kiilholma P. Outcome of thirty patients who underwent repair of posthysterectomy

prolapsed of the vaginal vault with abdominal sacral colpopexy. JACS. 1994;178:283-7.

63. Brubaker L. Sacrocolpopexy and the anterior compartment: support and function. Am J Obstet Gynecol. 1995;173:1690-6.
64. de Vries MJ, vanDessel TH, Drogendijk AC, de Haas I, Huikeshoven FJ. Short-term results and long-term patients' appraisal of abdominal colposacropexy for treatment of genital and vaginal vault prolapse. Eur J Obstet Gynecol Reprod Biol 1995;59:35-8.
65. Hardiman PJ, Drutz HP. Sacrospinous vault suspension and abdominal colposacropexy: success rates and complications. American Journal of Obstetrics & Gynecology. 1996 Sep.;175((3 Pt 1)):612-6.
66. Cundiff GW, Harris RL, Coates K, Low VH, Bump RC, Addison WA. Abdominal sacral colpoperineopexy: a new approach for correction of posterior compartment defects and perineal descent associated with vaginal vault prolapse. American Journal of Obstetrics & Gynecology. 1997;177(6):1345-53; discussion 53-5.
67. Ross JW. Techniques of laparoscopic repair of total vault eversion after hysterectomy. J Am Assoc Gynecol Laparosc. 1997;4:173-83.
68. Costantini E, Lombi R, Micheli C, Parziani S, Porena M. Colposacropexy with Gore-tex mesh in marked vaginal and uterovaginal prolapse. Eur Urol. 1998;34:111-7.
69. Occelli B, Narducci F, Cosson M, Ego A, Decocq J, Querleu D, et al. Abdominal colposacroplexy for the treatment of vaginal vault prolapse with or without urinary stress incontinence. Ann Chir 1999;53:367-77.
70. Patsner B. Abdominal sacral colpopexy in patients with gynecologic cancer: report of 25 cases with long-term follow-up and literature review. Gynecol Oncol 1999;75:504-8.
71. Pilsgaard K, Mouritsen L. Follow-up after repair of vaginal vault prolapse with abdominal colposacropexy. Acta Obstet Gynecol Scand. 1999;78:66-70.
72. Schettini M, Fortunato P, M. G. Abdominal sacral colpopexy with prolene mesh. Int Urogyn J. 1999;10:295-9.
73. Sze EH, et al. A retrospective comparison of abdominal sacrocolpopexy with Burch colposuspension versus sacrospinous fixation with transvaginal needle suspension for the management of vaginal vault prolapse and coexisting stress incontinence. Int J Urogynecol. 1999;10(6):390-3.
74. Diana M, Zoppe C, Mastrangeli B. Treatment of vaginal vault prolapse with abdominal sacral colpopexy using prolene mesh. Am J Surg 2000;179:126-8.
75. Fox SD, Stanton SL. Vault prolapse and rectocele: assessment of repair using sacrocolpopexy with mesh interposition. BJOG: An International Journal of Obstetrics & Gynaecology. 2000 Nov;107(11):1371-5.
76. Nieminen K, Heinonen PK. Long-term outcome of abdominal sacral colpopexy or vaginal sacrospinous ligament fixation for posthysterectomy vaginal vault prolapse. J Pelvic Surg. 2000;5:254-60.
77. Winters JC, Cespedes RD, Vanlangendonck R. Abdominal sacral colpopexy and abdominal enterocele repair in the management of vaginal vault prolapse. Urology. 2000;56(6 Suppl):55-63.
78. Baessler K, Schuessler B. Abdominal sacrocolpopexy and anatomy and function of the posterior compartment. Obstetrics & Gynecology. 2001;97(5 Pt 1):678-84.
79. Geomini PM, Brolmann HA, van Binsbergen NJ, Mol BW. Vaginal vault suspension by abdominal sacral colpopexy for prolapse: a follow-up study of 40 patients. Eur J Obstet Gynecol Reprod Biol 2001;94:234-8.
80. Scarpero HM, Cespedes RD, Winters JC. Transabdominal approach to repair vaginal vault prolapse. Tech Urol. 2001;7:139-45.
81. Sullivan ES, Longaker CJ, Lee PY. Total pelvic mesh repair: a ten-year experience. Diseases of the Colon & Rectum. 2001;44(6):857-63.
82. Collopy BT, Barham KA. Abdominal colporectopexy with pelvic cul-de-sac closure. Dis Colon Rectum. 2002;45:522-9.
83. Cosson M, Rajabally R, Bogaert E, Querleu D, Crepin G. Laparoscopic sacrocolpopexy, hysterectomy, and burch colposuspension: feasibility and short-term complications of 77 procedures. JSLS. 2002;6:115-9.
84. Culligan PJ, Murphy M, Blackwell L, Hammons G, Graham C, Heit MH. Long-term success of abdominal sacral colpopexy using synthetic mesh. Am J Obstet Gynecol 2002;187:1473-82.
85. Lefranc JP, Atallah D, Camatte S, Blondon J. Longterm followup of posthysterectomy vaginal vault prolapse abdominal repair: a report of 85 cases. J Am Coll Surg. 2002;195:352-8.
86. Leonardo C, Gentili G, Leonardo F. Abdominal sacral colpopexy with Mersilene mesh. Urol Int. 2002;68:6-9.
87. Lindeque BG, Nel WS. Sacrocolpopexy—a report on 262 consecutive operations. S Afr Med J 2002;92:982-5.
88. Medina CA, Pietro PA, Whitted RW, Penalver M. The use of dura mater allografts for abdominal sacral colpopexy. J Pelvic Surg 2002;8:247-51.
89. Reddy K, TG. M. Short-term and long-term follow-up of abdominal sacrocolpopexy for vaginal vault prolapse: initial experience in a district general hospital. . J Obstet Gynaecol 2002;22:532-6.
90. Roovers JP, van der Bom JG, van der Vaart CH, Schagen van Leeuwen JH, Heintz AP. Abdominal versus vaginal approach for the management of genital prolapse and coexisting stress incontinence. Int Urogynecol J Pelvic Floor Dysfunct. 2002;13:224-31.
91. Brizzolara S, Pillai-Allen A. Risk of mesh erosion with sacral colpopexy and concurrent hysterectomy. Obstet Gynecol. 2003 Aug;102(2):306-10.
92. Marinkovic SP, Stanton SL. Triple compartment prolapse: sacrocolpopexy with anterior and posterior mesh extensions. BJOG Int J Obstet & Gynaecol. 2003 Mar;110(3):323-6.
93. Sanz LE, Verosko J. Modification of abdominal sacrocolpopexy using a suture anchor system. J Reprod Med. 2003;48:496-500.
94. Podratz KC, Ferguson LK, Hoverman VR, Lee RA, Symmonds RE. Abdominal sacral colpopexy for posthysterectomy vaginal vault descensus. J Pelvic Surg 1995;1:18-23.
95. Hilger WS, Poulson M, Norton PA. Long-term results of abdominal sacrocolpopexy. Am J Obstet Gynecol. 2003;189:1606-10.
96. Lo T-S, Wang AC. Abdominal colposacropexy and sacrospinous ligament suspension for severe uterovaginal prolapse: a comparison. J Gynecol Surg 1998;14:59-64.
97. Culligan PJ, Blackwell L, Goldsmith LJ, Graham CA, Rogers A, Heit MH. A randomized controlled trial comparing fascia lata and synthetic mesh for sacral colpopexy. Obstetrics & Gynecology. 2005;106(1):29-37.
98. Visco AG, Weidner AC, Barber MD, Myers ER, Cundiff GW, Bump RC, et al. Vaginal mesh erosion after abdominal sacral colpopexy. American Journal of Obstetrics & Gynecology. 2001;184(3):297-302.
99. Bensinger G, Lind L, Lesser M, Guess M, Winkler H. Abdominal sacral suspensions: Analysis of complications using permanent mesh. AJOG. 2005;193(6):2094-98.

100. Wu J, Wells E, Hundley A, Connolly A, Williams K, Visco A. Mesh erosion in abdominal sacral colpopexy with and without concomitant hysterectomy. American Journal of Obstetrics and Gynecology. 2006 May;194(5):1418-22.

101. FitzGerald MP, Edwards SR, Fenner D. Medium-term follow-up on use of freeze-dried, irradiated donor fascia for sacrocolpopexy and sling procedures. International Urogynecology Journal. 2004 Jul-Aug;15(4):238-42.

102. FitzGerald MP, Mollenhauer J, Bitterman P, Brubaker L. Functional failure of fascia lata allografts. Am J Obstet Gynecol 1999;181:1339-46.

103. FitzGerald MP, Mollenhauer J, Brubaker L. Failure of allograft suburethral slings. B J Urol 1999;84:785-5.

104. FitzGerald MP, Mollenhauer J, Brubaker L. The fate of rectus fascia suburethral slings. Am J Obstet Gynecol 2000;183:964-6.

105. Flynn MK, Webster GD, Amundsen CL. Abdominal sacral colpopexy with allograft fascia lata: One-year outcomes. AJOG. 2005;192:1496-500.

106. Whitehead WE, Bradley CS, Brown MB, Brubaker L, Gutman RE, Varner RE, et al. Gastrointestinal Complications Following Abdominal Sacrocolpopexy for Advanced Pelvic Organ Prolapse. Am J Obstet Gynecol. 2007;197:78.e1-.e7)

107. von Theobald P, Cheret A. Laparascopic sacrocolpopexy: results of a 100-patient series with 8 years follow-up. Gynecol Surg. 2004;1:31-6.

108. Higgs P, Goh J, Krause H, Sloane K, Carey M. Abdominal sacral colpopexy:an independent prospective long-term follow-up study. Austr New Zeal J Obstet Gynaecol. 2005;45:430-4.

109. Cruikshank SH, Kovac SR, et al. Randomized comparison of three surgical methods used at the time of vaginal hysterectomy to prevent posterior enterocele. Am J Obstet Gynecol. 1999;180:859-65.

110. Shull BL, Capen CV, Riggs MW, Kuehl TJ. Bilateral attachment of the vaginal cuff to iliococcygeus fascia: an effective method of cuff suspension. American Journal of Obstetrics & Gynecology. 1993 Jun;168(6 Pt 1):1669-74; discussion 1674-7):1674-7.

111. Meeks GR, Washburne JF, McGehee RP, Wiser WL. Repair of vaginal vault prolapse by suspension of the vagina to iliococcygeus (prespinous) fascia. American Journal of Obstetrics & Gynecology. 1994 Dec;171(6):1444-52; discussion 52-4.

112. Maher CF, Murray CJ, Carey MP, Dwyer PL, Ugoni AM. Iliococcygeus or sacrospinous fixation for vaginal vault prolapse. Obstetrics & Gynecology. 2001 Jul;98(1):40-4.

113. Francis WJ, Jeffcoate TN. Dyspareunia following vaginal operations. J Obstet Gynaecol Br Commonw. 1961;68:1-10.

114. Webb MJ, Aronson MP, L.K. F, R.A. L. Posthysterectomy Vaginal Vault Prolapse: Primary Repair in 693 Patients. Obstetrics & Gynecology. 1998;92(2):281-85.

115. Aronson MP, Aronson PK, Howard AE, Morse AN, Baker SP, Young SB. Low risk of ureteral obstruction with “deep” (dorsal/posterior) uterosacral ligament suture placement for transvaginal apical suspension. Am J Obstet Gynecol. 2005;192(5):1530-6.

116. Sederl J. Zur operation des prolapses der blind endigenden sheiden. Geburtshilfe Frauenheilkd. 1958;18:824-8.

117. Holley RL, Varner RE, Gleason BP, Apffel LA, Schott S. Recurrent pelvic support defects after sacrospinous ligament fixation for vaginal vault prolapse. JACS. 1995;180:444-48.

118. Sze EH, Karram MM. Transvaginal repair of vault prolapse: a review. Obstet Gynecol. 1997 466-75;89(3).

119. Shull BL, Capen CV, Riggs MW, Kuehl TJ. Preoperative and postoperative analysis of site-specific pelvic support defects in 81 women treated with sacrospinous ligament suspension and pelvic reconstruction. Am J Obstet Gynecol. 1992 Jun;166(6 Pt 1):1764-8; discussion 8-71.

120. Pasley WW. Sacrospinous suspension: a local practitioner’s experience. Am J Obstet Gynecol. 1995 Aug;173(2):440-5; discussion 5-8.

121. Paraiso MF, Ballard LA, Walters MD, Lee JC, Mitchinson AR. Pelvic support defects and visceral and sexual function in women treated with sacrospinous ligament suspension and pelvic reconstruction. American Journal of Obstetrics & Gynecology. 1996;175(6):1423-30; discussion 30-1.

122. Penalver M, Mekki Y, Lafferty H, Escobar M, Angioli R. Should sacrospinous ligament fixation for the management of pelvic support defects be part of a residency program procedure? The University of Miami experience. Am J Obstet Gynecol. 1998 Feb;178(2):326-9.

123. Colombo M, Milani R. Sacrospinous ligament fixation and modified McCall culdoplasty during vaginal hysterectomy for advanced uterovaginal prolapse. Am J Obstet Gynecol. 1998 Jul;179(1):13-20.

124. Meschia M, Bruschi F, Amicarelli F, Pifarotti P, Marchini M, Crosignani PG. The sacrospinous vaginal vault suspension: Critical analysis of outcomes. Int Urogynecol J Pelvic Floor Dysfunct. 1999;10(3):155-9.

125. Lantzsch T, Goepel C, Wolters M, Koelbl H, Methfessel HD. Sacrospinous ligament fixation for vaginal vault prolapse. Arch Gynecol Obstet. 2001 Mar;265(1):21-5.

126. Miller N. A new method of correcting complete inversion of the vagina: with or without complete prolapse; report of two cases. Surg Gynecol Obstet 1927:550-5.

127. Shull BL, et al. A transvaginal approach to repair of apical and other associated sites of pelvic organ prolapse with uterosacral ligaments. Am J Obstet Gynecol. 2000;183(6):1365-73; Discussion 73-4.

128. Jenkins VR, 2nd. Uterosacral ligament fixation for vaginal vault suspension in uterine and vaginal vault prolapse. Am J Obstet Gynecol. 1997 Dec;177(6):1337-43; discussion 43-4.

129. Comiter CV, Vasavada SP, Raz S. Transvaginal culdosuspension: technique and results. Urology. 1999 Nov;54(5):819-22.

130. Barber MD, Visco AG, Weidner AC, Amundsen CL, Bump RC. Bilateral uterosacral ligament vaginal vault suspension with site-specific endopelvic fascia defect repair for treatment of pelvic organ prolapse. Am J Obstet Gynecol. 2000 Dec;183(6):1402-10; discussion 10-1.

131. Karram M, Goldwasser S, Kleeman S, Steele A, Vassallo B, Walsh P. High uterosacral vaginal vault suspension with fascial reconstruction for vaginal repair of enterocele and vaginal vault prolapse. Am J Obstet Gynecol. 2001 Dec;185(6):1339-42; discussion 42-3.

132. Amundsen CL, Flynn BJ, Webster GD. Anatomical correction of vaginal vault prolapse by uterosacral ligament fixation in women who also require a pubovaginal sling. J Urol. 2003 May;169(5):1770-4.

133. Silva WA, Pauls RN, Segal JL, Rooney CM, Kleeman SD, Karram MM. Uterosacral ligament vault suspension: five-year outcomes. Obstet Gynecol. 2006 Aug;108(2):255-63.

134. Kelly HA. Incontinence of urine in women. Urol Cutaneous. 1913;17:291-3.

135. Macer GA. Transabdominal repair of cystocele, a 20 year experience, compared with the traditional vaginal approach. Am J Obstet Gynecol. 1978;131:203-7.

136. Porges RF, SW S. Long-term analysis of the surgical

management of pelvic support defects. Am J Obstet Gynecol. 1994:1518-28.

137. Stanton SL, Hilton P, Norton C, Cardozo L. Clinical and urodynamic effects of anterior colporrhaphy and vaginal hysterectomy for prolapse with and without incontinence. Br J Obstet Gynaecol. 1982;89:459-63.
138. Walter S, Olesen KP, Hald T, Jensen HK, Pedersen PH. Urodynamic evaluation after vaginal repair and colposuspension. Br J Urol. 1982;54:377-80.
139. Weber AM, Walters MD, Piedmonte MR, Ballard LA. Anterior colporrhaphy: a randomized trial of three surgical techniques. Am J Obstet Gynecol. 2001;185:1299-304.
140. Sand PK, Koduri S, Lobel RW, et al Prospective randomized trial of polyglactin 910 mesh to prevent recurrence of cystoceles and rectoceles. Am J Obstet Gynecol. 2001;184:1357-62.
141. Colombo M, Vitobello D, Proietti F, Milani R. Randomised comparison of Burch colposuspension versus anterior colporrhaphy in women with stress urinary incontinence and anterior vaginal wall prolapse. BJOG. 2000;107:544-51.
142. White GR. An anatomic operation for the cure of cystocele. Am J Obstet Dis Women Children. 1912;65:286-90.
143. Shull BL, Benn SJ, Kuehl TJ. Surgical management of prolapse of the anterior vaginal segment: An analysis of support defects, operative morbidity, and anatomical outcome. Am J Obstet Gynecol. 1994;171(6):1429-39.
144. Grody MHT, Nyirjesy P, Kelley LM, Millar ML. Paraurethral fascial sling urethropexy and vaginal paravaginal defects cystopexy in the correction of urethrovesical prolapse. Int Urogynecol J Pelvic Flor Dystunct. 1995;6:80-5.
145. Elkins TE, Chesson RR, Videla F, Menefee S, Yordan R, Barksdale A. Transvaginal paravaginal repair. A useful adjunctive procedure at pelvic relaxation surgery. J Pelvic Surg. 2000;6:11-5.
146. Mallipeddi PK, Steele AC, Kohlin N, Karram MM. Anatomic and functional outcome of vaginal paravaginal repair in the correction of anterior vaginal wall prolapse. Int Uorgynecol J Pelvic Floor Dysfunct. 2001;12:83-8.
147. Young SB, Daman JJ, Bony LG. Vaginal paravaginal repair: one-year outcomes. American Journal of Obstetrics & Gynecology. 2001;185(6):1360-6; discussion 6-7.
148. Morse AN, O'Dell KK, Howard AE, Baker SP, Aronson MP, Young SB. Midline anterior repair alone vs anterior repair plus vaginal paravaginal repair: a comparison of anatomic and quality of life outcomes. International Urogynecology Journal And Pelvic Floor Dysfunction. 2007;18(3):245-9.
149. Richardson AC, Lyon JB, Williams NL. A new look at pelvic relaxation. American Journal of Obstetrics & Gynecology. 1976 Nov 1.;126(5):568-73.
150. Richardson AC, Edmonds PB, Williams NL. Treatment of stress urinary incontinence due to paravaginal fascial defect. Obstet Gynecol. 1981;57:357-62.
151. Shull BL, Baden WB. A six-year experience with paravaginal defect repair for stress urinary incontinence. Am J Obstet Gynecol. 1989;160:1432-40.
152. Bruce RG, El Galley RE, Galloway NT. Paravaginal defect repair in the treatment of female stress urinary incontinence and cystocele. Urology. 1999;54:647-51.
153. Scotti RJ, Garely AD, Greston WM, Flora RF, Olson TR. Paravaginal repair of lateral vaginal wall defects by fixation to the ischial periosteum and obturator membrane. Am J Obstet Gynecol. 1998;179:1436-45.
154. Raz S, Klutke CG, Golomb J. Four-corner bladder and urethral suspension for moderate cystocele. Journal of Urology. 1989;142(3):712-5.
155. Raz S, Little NA, Juma S, Sussman EM. Repair of severe anterior vaginal wall prolapse (grade IV cystourethrocele). Journal of Urology. 1991 Oct;146(4):988-92.
156. Gardy M, Kozminski M, DeLancey J, Elkins T, McGuire EJ. Stress incontinence and cystoceles. Journal of Urology. 1991;145(6):1211-3.
157. Benizri EJ, Volpe P, Pushkar D, Chevallier D, Amiel J, Sanian H, et al. A new vaginal procedure for cystocele repair and treatment of stress urinary incontinence. J Urol. 1996;156(5):1623-5.
158. Dmochowski RR, Zimmern PE, Ganabathi K, Sirls L, Leach GE. Role of the Four-Corner Bladder Neck Suspension to Correct Stress Incontinence With a Mild to Moderate Cystocele. Urology. 1997;49(1):35-40.
159. Cross CA, Cespedes RD, McGuire EJ. Treatment results using pubovaginal slings in patients with large cystoceles and stress incontinence. J Urol. 1997;158(2):431-4.
160. Safir MH, Gousse AE, Rover ES, Ginsberg DA, Raz S. 4-defect repair of grade 4 cystocele. J Urol. 1999;161:587-94.
161. Goldberg RP, Koduri S, Lobel RW, et.al. Protective effect of suburethral slings on postoperative cystocele recurrence after reconstructive pelvic operation. Am J Obstet Gynecol. 2001;185:1307-12.
162. Arnold MW, Stewart WR, Aguilar PS. Rectocele repair. Four years' experience. Diseases of the Colon & Rectum. 1990;33(8):684-7.
163. Lopez A, Anzen B, Bremmer S, Mellgren A, Nilsson BY, Zetterstrom J, et al. Durability of Success after Rectocele Repair. Int Urogynecol J Pelvic Floor Dystunct. 2001;12:97-103.
164. Kahn MA, Stanton SL. Posterior colporrhaphy: its effects on bowel and sexual function. BJOG. 1997;104:82-6.
165. Mellgren A, Anzen B, Nilsson BY, Johansson D, Dolk A, Gillgren P, et al. Results of rectocele repair. A prospective study. . Dis Colon Rectum. 1995 Jan;38(1):7-13.
166. Maher C. Midline rectovaginal fascial plication for repair of rectocele and obstructed defecation. Obstet & Gynecol. 2004 Oct;104(4):685-9.
167. Singh K, Cortes E, Reid WM. Evaluation of the fascial technique for surgical repair of isolated posterior vaginal wall prolapse. Obstet & Gynecol. 2003;101(2):320-4.
168. Robinson D WS, Cardozo L, Bidmead J, Balmforth J. Fascial posterior colpoperineorrhaphy: A five year follow- up study. . Journal Of Pelvic Medicine and Surgery. 2003; 9(6):279-83.
169. Richardson AC. The rectovaginal septum revisited; its relationship to rectocele and its importance in rectocele repair. Clinical Obstetrics & Gyneaecology. 1993;36:976-83.
170. Cundiff GW, Weidner AC, Visco AG, Addison WA, Bump RC. An anatomic and functional assessment of the discrete defect rectocele repair. Am J Obstet Dis Women Children. 1998 Dec;179(6 Pt 1):1451-6; discussion 6-7.
171. Kenton K, Shott S, Brubaker L. Outcome after rectovaginal fascia reattachment for rectocele repair. Am J Obstet Gynecol. 1999 Dec;181(6):1360-3.
172. Porter WE, Steele A, Walsh P, Kohli N, Karram MM. The anatomic and functional outcomes of defect-specific rectocele repairs. American Journal of Obstetrics & Gynecology. 1999 Dec;181(6):1353-8.
173. Abramov Y, Gandhi S, Goldberg RP, Botros SM, Kwon C, Sand PK. Site-specific rectocele repair compared with standard posterior colporrhaphy. Obstet Gynecol. 2005 Feb;105(2):314-8.
174. Paraiso MF, Barber MD, Muir TW, Walters MD. Rectocele repair: a randomized trial of three surgical techniques including graft augmentation. American Journal of Obstetrics & Gynecology 2006 Dec;195(6):1762-71.

175. Nieminen, Hiltunen, Laitinen, Oksala, Heinonen. Transanal or vaginal approach to rectocele repair: Results of a prospective randomised study.; 2003; 2003. p. 57-48.

176. Puigdollers A, Fernández-Fraga X, Azpiroz F. Persistent symptoms of functional outlet obstruction after rectocele repair. Colorectal Dis. 2007;9(3):262-5.

177. Thornton MJ, Lam A, King DW. Laparoscopic or transanal repair of rectocele? A retrospective matched cohort study. Dis Colon Rectum. 2005 Apr;48:792-8.

178. van Dam JH, Huisman WM, Hop WC, Schouten WR. Fecal continence after rectocele repair: a prospective study. International Journal of Colorectal Disease. 2000 Feb;15(1):54-7.

179. Su KC, Mutone MF, Terry CL, Hale DS. Abdominovaginal sacral colpoperineopexy: patient perceptions, anatomical outcomes, and graft erosions. Int Urogyn J. 2007;18:503-11.

180. Lyons TL, Winer WK. Laparoscopic rectocele repair using polyglactin mesh. Journal of the American Association of Gynecologic Laparoscopists. 1997 May;4(3):381-4.

181. FitzGerald MP, Richter HE, Siddique S, Thompson P, Zyczynski H, Weber A, for the Pelvic Floor Disorders Network. Colpocleisis: A review. Int Urogyn J. 2006;17:261-71.

182. Hullfish KL, Bovbjerg VE, Steers WD. Colpocleisis for Pelvic Organ Prolapse. Obstet & Gynecol. 2007;110(2 Pt. 1):341-45.

183. Wheeler T, Richter HE, Burgio KL, Redden DT, Chen CCG, Goode PS, et al. Regret, satisfaction, and symptom improvement: Analysis of the impact of partial colpocleisis for the management of severe pelvic organ prolapse. AJOG. 2005;193:2067-70.

184. Barber MD, Paraiso MF, Romero A. Quality of life after surgery for genital prolapse in elderly women: obliterative and reconstructive surgery. Int Urogyn J. 2007;18:799-806.

185. FitzGerald MP, Richter H, E, , Bradley CS, Visco AC, Cundiff GW, Zyczynski HM, et al. Pelvic support, pelvic symptoms and patient satisfaction after colpocleisis. Int Urogyn J. Submitted.

186. Kohli N, Sze EH, Roat T, Karram MM. Incidence of recurrent cystocele after anterior colporrhaphy with and without concomitant transvaginal needle suspension. Am J Obstet Gynecol 1996;175. Am J Obstet Gynecol. 1996;175.

187. Banu LF. Synthetic sling for genital prolapse in young women. Int J Gynaecol Obstet. 1997 Apr;57(1):57-64.

188. Leron E, Stanton SL. Sacrohysteropexy with synthetic mesh for the management of uterovaginal prolapse. . BJOG: An International Journal of Obstetrics & Gynaecology. 2001;108(6):629-33.

189. Maher CF, Cary MP, Slack MC, Murray CJ, Milligan M, Schluter P. Uterine preservation or hysterectomy at sacrospinous colpopexy for uterovaginal prolapse? Int Urogynecol J Pelvic Flor Dystunct. 2001;12(6):381-4.

190. Jeon MJ, Jung HJ, Choi HJ, Kim SK, Bai SW. Is hysterectomy or the use of graft necessary for the reconstructive surgery for uterine prolapse? Int Urogynecol J Pelvic Floor Dysfunct. 2008 Mar;19(3):351-5.

191. Dietz V, de Jong J, Huisman M, Schraffordt Koops S, Heintz P, van der Vaart H. The effectiveness of the sacrospinous hysteropexy for the primary treatment of uterovaginal prolapse. Int Urogyn J. 2007;18(11):1271-6.

192. Hefni M, El-Toukhy T, Bhaumik J, Katsimanis E. Sacrospinous cervicocolpopexy with uterine conservation for uterovaginal prolapse in elderly women: an evolving concept. Am J Obstet Gynecol 2003 Mar;188(3):645-50.

193. van Brummen HJ, van de Pol G, Aalders CI, Heintz AP, van der Vaart CH. Sacrospinous hysteropexy compared to vaginal hysterectomy as primary surgical treatment for a descensus uteri: effects on urinary symptoms. Int Uorgynecol J Pelvic Floor Dysfunct. 2003;14(5):350-5; discussion 5.

194. Neuman M, Lavy Y. Conservation of the prolapsed uterus is a valid option: medium term results of a prospective comparative study with the posterior intravaginal slingoplasty operation. Int Urogynecol J Pelvic Flor Dystunct. 2007;18:889-93.

195. Fedorkow DM, Kalbfleisch RE. Total abdominal hysterectomy at abdominal sacrovaginopexy: a comparative study. Am J Obstet Gynecol. 1993 Sep;169(3):641-3.

196. Belot F, Collinet P, Debodinance P, Ha Duc E, Lucot JP, Cosson M. Risk factors for prosthesis exposure in treatment of genital prolapse via the vaginal approach. Gynecologie, Obstetrique & Fertilite. 2005 dEC;33(12):970-4.

197. Gauruder-Burmester A, Koutouzidou P, Rohne J, Gronewold M, Tunn R. Follow-up after polypropylene mesh repair of anterior and posterior compartments in patients with recurrent prolapse. Int J Urogynecol. 2007;18:1059-64.

198. Collinet P, Belot F, Debodinance P, Ha Duc E, Lucot JP, Cosson M. Transvaginal mesh technique for pelvic organ prolapse repair: mesh exposure management and risk factors. Int Urogyn J. 2006;17(4):315-20.

199. Kleeman SD, Vassallo B, Segal J, Hungler M, Karram M. The ability of history and a negative cough stress test to detect occult stress incontinence in patients undergoing surgical repair of advanced pelvic organ prolapse. Int Urogyn J 2006;17:27-9.

200. Reena C, Kekre AN, Kekre N. Occult stress incontinence in women with pelvic organ prolapse. Int J Gynaecol Obstet. 2007;97:31-4.

201. Kenton K, Fitzgerald MP, Brubaker L. Striated urethral sphincter activity does not alter urethral pressure during filling cystometry. American Journal of Obstetrics & Gynecology. 2005;192(1):55-9.

202. Mueller ER, Kenton K, Mahajan S, Fitzgerald MP, Brubaker L. Urodynamic Prolapse Reduction Alters Urethral Pressure but Not Filling or Pressure Flow Parameters. Journal of Urology. 2007 Feb;177(2):600-3.

203. Visco AG, Brubaker L, Cundiff G, Fine P, Nygaard I, Richter HE, et al. The Role of Pre-Operative Urodynamic Testing in Stress Continent Women. Undergoing Sacrocolpopexy: The Colpopexy and Urinary Reduction Efforts (CARE) Randomized Surgical Trial. Int J Urogynecol. 2008;19:607-14.

204. Costantini E, Zucchi A, Giannantoni A, Mearini L, Bini V, Porena M. Must colposuspension be associated with sacropexy to prevent postoperative urinary incontinence? Eur Urol 2007;51:788-94.

205. Meschia M, Pifarotti P, Spennacchio M, Buonaguidi A, Gattei U, Somigliana E. A randomized comparison of tension-free vaginal tape and endopelvic fascia plication in women with genital prolapse and occult stress urinary incontinence. Am J Obstet Gynecol. 2004;190:609-13.

206. Hiltunen R, Nieminen K, Takala T, et al. Low-weight polypropylene mesh for anterior vaginal wall prolapse: a randomized controlled trial. Obstet Gynecol. 2007;110((2 Pt 2)):455-62.

207. Colombo M, Maggioni A, Zanetta G, Vignali M, Milani R. Prevention of postoperative urinary stress incontinence after surgery for genitourinary prolapse. Obstet & Gynecol. 1996;87:266-71.

208. Colombo M, Maggioni A, Scalambrino S, Vitobello D, Milani R. Surgery for genitourinary prolapse and stress incontinence: a randomized trial of posterior pubourethral ligament plication and Pereyra suspension. Am J Obstet Gynecol 1997;176:337-43.

209. Gordon D, Groutz A, Wolman I, Lessing JB, David MP. Development of postoperative urinary stress incontinence in clinically continent patients undergoing prophylactic Kelly plication during genitourinary prolapse repair. Neurourol Urodyn 1999;18:197-97.

210. Chaikin DC, Groutz A, Blaivas JG. Predicting the need for anti-incontinence surgery in continent women undergoing repair of severe urogenital prolapse. Journal of Urology. 2000;163(2):531-4.

211. Klutke JJ, Ramos S. Urodynamic outcome after surgery for severe prolapse and potential stress incontinence. American Journal of Obstetrics & Gynecology. 2000;182(6):1378-81.

212. Groutz A, Gordon D, Wolman I, Jaffa AJ, Kupferminc MJ, David MP, et al. The use of prophylactic Stamey bladder neck suspension to prevent post-operative stress urinary incontinence in clinically continent women undergoing genitourinary prolapse repair. Neurourol Urodyn. 2000;19:671-76.

213. Yamada T, Ichiyanagi N, Kamata S, Sakai Y, Nagahama K, Tanizawa A, et al. Need for sling surgery in patients with large cystoceles and masked stress urinary incontinence. International Journal of Urology. 2001;8(11):599-603.

214. Gordon D, Gold RS, Pauzner D, Lessing JB, Groutz A. Combined genitourinary prolapse repair and prophylactic tension-free vaginal tape in women with severe prolapse and occult stress urinary incontinence: preliminary results. Urology. 2001;58:547-50.

215. Barnes NM, Dmochowski RR, Park R, Nitti VW. Pubovaginal sling and pelvic prolapse repair in women with occult stress urinary incontinence: effect on postoperative emptying and voiding symptoms. Urology. 2002;59(6):856-60.

216. de Tayrac R, Gervaise AI, Chauveaud-Lambling A, Fernandez H. Combined genital prolapse repair reinforced with a polypropylene mesh and tension-free vaginal tape in women with genital prolapse and stress urinary incontinence: a retrospective case-control study with short-term follow-up. Acta Obstet Gynecol Scand. 2004;83:950-54.

217. Groutz A, Gold RS, Pauzner D, Lessing JB, Gordon D. Tension-free vaginal tape (TVT) for the treatment of occult stress urinary incontinence in women undergoing prolapse repair: a prospective study of 100 consecutive cases. Neurourol Urodyn. 2004;23:632-35.

218. Liang CC, Chang YL, Chang SD, Lo TS, Soong YK. Pessary test to predict postoperative urinary incontinence in women undergoing hysterectomy for prolapse. Obstet Gynecol. 2004;104:795-800.

219. Clemons JL, Aguilar VC, Sokol ER, Sung VW, Myers DL. Suburethral sling treatment of occult stress incontinence and intrinsic sphincter deficiency in women with severe vaginal prolapse of the anterior vs posterior/apical compartment. AmJ Obstet Gynecol 2005;192:1566-72.

220. Misrai V, Roupret M, Cour F, Chartier-Kastler E, Richard F. De novo urinary stress incontinence after laparoscopic sacral colpopexy. Br J Urol Int. 2008;101:594-97.

221. Gandhi S, Goldberg RP, Kwon C, et al A prospective randomized trial using solvent dehydrated fascia lata for the prevention of recurrent anterior vaginal wall prolapse. American Journal of Obstetrics and Gynecology 2005;192(5):1649-54.

222. Jarvis SK, et al. Per-operative physiotherapy improves outcomes for women undergoing incontinence and/or prolapse surgery: results of a randomized controlled trial. Aust N Z J Obstet Gynaecol 2005;45(4):300-3.

223. Bump RC, Norton PA. Epidemiology and natural history of pelvic floor dysfunction. Obstetrics & Gynecology Clinics of North America. 1998;25(4):723-46.

224. Richter HE, Goode PS, Kenton K, Brown MB, Burgio KL, Kreder K, et al. The effect of age on short-term outcomes after abdominal surgery for pelvic organ prolapse. J Am Geriatr Soc. 2007 Jun;55(6):857-63.

225. Bradley CS, Kenton K, Richter HE, Gao X, Zyczynski H, Weber A, et al. Obesity and Outcomes After Sacrocolpopexy. Am J Obest & Gynec. Accepted 2008.

226. Buchsbaum GM, Duecy EE, Kerr LA, Huang L, Pervich M, Guzick DS. Pelvic Organ Prolapse in Nulliparous Women and thier Parous Sisters. Obstet & Gynecol. 2006;108(6):1386-92.

227. Nguyen JN, Burchette RJ. Outcome after anterior vaginal prolapse repair: a randomized controlled trial. Obstet Gynecol. 2008;111(4):891-8.

228. Julian TM. The efficacy of Marlex mesh in the repair of severe, recurrent vaginal prolapse of the anterior midvaginal wall. Am J Obstet Gynecol. 1996;175:1472-5.

229. Flood CG, Drutz HP, Waja L. Anterior colporrhaphy reinforced with Marlex mesh for the treatment of cystoceles. Int Urogynecol J Pelvic Floor Dystunct. 1998;9:200-4.

230. Cervigni M, Natale F, La Penna, Panae M, Mako A. Transvaginal cystocele repair with polypropelene mesh using a tension-free technique. Int Urogynecol J Pelvic Floor Dysfunct. 2007;19(4):489-96.

231. Migliari R, De Angelis M, Madeddu G, Verdacchi T. Tension-free vaginal mesh repair for anterior vaginal wall prolapse. Eur Urol. 2000;38:151-5.

232. Migliari R, Usai.E. Treatment results using a mixed fiber mesh in patients with grade IV cystocele. J Urol 1999;161:1255-8.

233. Natale F, Marziali S, Cervigini M. Tension-free cystocele repair(TCR): Longterm follow-up. Int Urogynecol J Pelvic Floor Dystunct. 2000;11:S51.

234. Nicita G. A new operation for genitourinary prolapse. J Urol. 1998;160:741-5.

235. O'Reilly BA, D. P. Functional results of transvaginal surgery with atrium polypropylene mesh. Proceeds 2:Absract 90. 8th International Urogynecology Meeting 2003; Buenos Aires: Int Urogynecol J Pelvic Floor Dysfunct; 2003.

236. Salvatore S, Soligo M, Meschia M, Luppino G, P.V.A. P. Prosthetic surgery for genital prolapse: functional outcome. Neurourol Urodyn. 2002;21:296-7.

237. de Tayrac R, Picone O, Chauveaud-Lambling A, Fernandez H. A 2-year anatomical and functional assessment of transvaginal rectocele repair using a polypropylene mesh. Int J Urogynecol. 2006 Feb;17(2):100-5.

238. de Tayrac R, Devoldere G, Renaudie JL, Villard P, Guilbaud O, Eblin G. Prolapse repair by vaginal route using a new protected low-weight polypropylene mesh: 1-year functional and anatomical outcome in a prospective multicentre study. Int Urogynecol J Pelvic Floor Dystunct. 2007;18:251-56.

239. Sivaslioglu A, Unlubilgen E, Dolen I. A randomised comparison of polypropelene mesh surgery with site-specific surgery in treatment of cystocele. Int J Urogynecol. 2007;published online(DOI 10.1007/s00192-007-0465-y).

240. Nguyen JN, Burchette RJ. Outcome after anterior vaginal prolapse repair: a randomized controlled trial. Obstet Gynecol. 2008 Apr;111(4):891-8.

241. Fatton B, Amblard J, Debodinance P, Cosson M, Jacquetin B. Transvaginal repair of genital prolapse: preliminary results of a new tension-free vaginal mesh (Prolift technique)—a case series multicentric study. Int J Urogynecol. 2007 Jul;18(7):743-52.

242. Dwyer PL, O'Reilly BA. Transvaginal repair of anterior and posterior compartment prolapse with Atrium polypropylene mesh. BJOG: An International Journal of Obstetrics & Gynaecology 2004 Aug;111(8):831-6.

243. Cosson M, Collinet P, Occelli B, et al The vaginal patch plastron for vaginal cure of cystocele. Preliminary results for 47 patients. Eur J Obstet Gynecol Reprod Biol. 2001;95(1):73-80.

244. Frederick RW, Leach GE. Cadaveric prolapse repair with sling: Intermediate outcomes with 6 months to 5 years of followup. Journal of Urology. 2005;173(4):1229-33.

245. Groutz A, Chaikin DC, Theusen E, Blaivas JG. Use of cadaveric solvent-dehydrated fascia lata for cystocele repair—preliminary results. Urology. 2001;58(2):179-83.

246. Kobashi KC, Leach GE, Frederick R, Kuznetsov DD, Hsiao KC. Initial experience with rectocele repair using nonfrozen cadaveric fascia lata interposition. Urology. 2005 Dec;66(6):1203-7; discussion 7-8.

247. Powell CR, Simsiman AJ, Menefee SA. Anterior Vaginal Wall Hammock With Fascia Lata for the Correction of Stage 2 or Greater Anterior Vaginal Compartment Relaxation. Journal of Urology. 2004;171(1):264-7.

248. Chung SY, Franks M, Smith CP, et al Technique of combined pubovaginal sling and cystocele repair using a single piece of cadaveric dermal graft. Urology. 2002;59(4):538-41.

249. Clemons JL, Myers DL, Aguilar VC, Arya LA. Vaginal paravaginal repair with an AlloDerm graft. American Journal of Obstetrics and Gynecology 2003;189(6):1612-8.

250. Ward RM, Sung VW, Clemons JL, Myers DL. Vaginal paravaginal repair with an AlloDerm graft: Long-term outcomes. American Journal of Obstetrics and Gynecology 2007;197(6):670.

251. Simonds RJ, Holmberg SD, Hurwitz RL, Coleman TR, Bottenfield S, Conley LJ, et al. Transmission of human immunodeficiency virus type 1 from a seronegative organ and tissue donor. N Engl J Med. 1992;326:726-30.

252. Hathaway JK, Choe JM. Intact genetic material is present in commercially processed cadaver allografts used for pubovaginal slings. J Urology. 2002;168(3):1040-3.

253. Leboeuf L, Miles RA, Kim SS, Gousse AE. Grade 4 cystocele repair using four-defect repair and porcine xenograft acellular matrix (Pelvicol): Outcome measures using SEAPI. Urology. 2004;64(2):282-6.

254. Wheeler TL, 2nd., Richter HE, Duke AG, et al. Outcomes with porcine graft placement in the anterior vaginal compartment in patients who undergo high vaginal uterosacral suspension and cystocele repair. Am J Obest & Gynec. 2006;194(5):1486-91.

255. Handel LN, Frenkl TL, Kim YH. Results of Cystocele Repair: A Comparison of Traditional Anterior Colporrhaphy, Polypropylene Mesh and Porcine Dermis. Journal of Urology. 2007;178(1):153-6.

256. Gomelsky A, Rudy DC, Dmochowski RR. Porcine dermis interposition graft for repair of high grade anterior compartment defects with or without concomitant pelvic organ prolapse procedures. J Urol. 2004;171(4):1581-84.

257. Simsiman AJ, Luber KM, Menefee SA. Vaginal paravaginal repair with porcine dermal reinforcement: Correction of advanced anterior vaginal prolapse. Am J Obest & Gynec. 2006;195(6):1832-36.

258. Meschia M, Pifarotti P, Bernasconi F, Magatti F, Riva D, Kocjancic E. Porcine skin collagen implants to prevent anterior vaginal wall prolapse recurrence: a multicenter, randomized study. J Urol. 2007 Jan;177(1):192-5.

259. Jo H, Kim JW, Park NH, Kang SB, Lee HP, Song YS. Efficacy and outcome of anterior vaginal wall repair using polypropylene mesh (Gynemesh). J Obstet Gynaecol Res. 2007;33(5):700-4.

260. Rodriguez LV, Bukkapatnam R, Shah SM, Raz S. Transvaginal paravaginal repair of high-grade cystocele central and lateral defects with concomitant suburethral sling: Report of early results, outcomes, and patient satisfaction with a new technique. Urology. 2005;66(5, Supplement 1):57-65.

261. Amrute KV, Eisenberg ER, Rastinehad AR, et al Analysis of outcomes of single polypropylene mesh in total pelvic floor reconstruction. Neurourol Urodyn. 2007;26(1):53-8.

262. de Tayrac R, Gervaise AI, et al. Tension-free polypropylene mesh for vaginal repair of anterior vaginal wall prolapse. J Reprod Med. 2005;50(2):75-80.

263. de Tayrac R, Deffieux X, A.L. G, Chauveaud-Lambling AL, Fernandez H. Long-term anatomical and functional assessment of trans-vaginal cystocele repair using a tension-free polypropylene mesh. 2006;17:483-8.

264. Altman D, Falconer C. Perioperative morbidity using transvaginal mesh in pelvic organ prolapse repair. Obstet Gynecol. 2007 eb;109:303-8.

265. Kobashi KC, Leach GE, Chon J, Govier FE. Continued Multicenter Followup of Cadaveric Prolapse Repair With Sling. The Journal of Urology. 2002;168(5):2063-8.

266. Salomon LJ, Detchev R, Barranger E, Cortez A, Callard P, Darai E. Treatment of Anterior Vaginal Wall Prolapse with Porcine Skin Collagen Implant by the Transobturator Route: Preliminary Results. European Urology. 2004;45(2):219-25.

267. Robles JE, Rioja J, Saiz A, Brugarolas X, Rosell D, Zudaire JJ, et al. Anterior compartment prolapse repair with a hybrid biosynthetic mesh implant technique. International Urogynecology Journal And Pelvic Floor Dysfunction. 2007;18(10):1191-6.

268. Lim YN, Muller R, Corstiaans A, Hitchins S, Barry C, Rane A. A long-term review of posterior colporrhaphy with Vypro 2 mesh. Int J Urogynecol. 2007;18:1053-57.

269. Milani R, Salvatore S, Soligo M, Pifarotti P, Meschia M, Cortese M. Functional and anatomical outcome of anterior and posterior vaginal prolapse repair with prolene mesh. BJOG: An International Journal of Obstetrics & Gynaecology. 2005 Jan;112(1):107-11.

270. Parker MC, Phillips RK. Repair of rectocele using Marlex mesh. Ann R Coll Surg Engl. 1993;75(3):193-4.

271. Altman D, Zetterström J, Mellgren A, Gustafsson C. A Three-Year Prospective Assessment of Rectocele Repair Using Porcine Xenograft. Obstet Gynecol. 2006;107(1):59-65.

272. Ghoniem GM. Allograft sling material: is it the state of the art? Int Urogynecol J Pelvic Floor Dysfunct. 2000;11(2):69-70.

273. Kohli N, Miklos JR. Dermal graft-augmented rectocele repair. Int Uorgynecol J Pelvic Floor Dysfunct. 2003 Feb 13;14(2):146-9.

274. Leventoglu S, Mentes BB, Akin M, Karen M, Karamercan A, Oguz M. Transperineal rectocele repair with polyglycolic acid mesh: a case series. Dis Colon Rectum. 2007 Dec;50(12):2085-92.

275. Abdel-Fattah M, Ramsay I. Retrospective multicentre study of the new minimally invasive mesh repair devices for pelvic organ prolapse. BJOG. 2008;115:22-30.

276. Biertho I, Dallemagne B, Dewandre JM, Markiewicz S, Monami B, Wahlen C, et al. Intravaginal slingplasty: short term results. Acta Chir Belg. 2004;104:700-4.

277. Foote AJ, Ralph J. Infracoccygeal sacropexy. Aust N Z J Obstet Gynaecol. 2007;47:250-1.

278. Mattox TF, Moore S, Stanford EJ, Mills BB. Posterior vaginal sling experience in elderly patients yields poor results. Am J Obstet & Gynec. 2006;194:1462-6.

279. Vardy M, Brodman M, Dorchak J, Dietrich M, Olivera C, Blumenstock E, et al. Anterior IVS tunnellerTM device for stress incontinence and posterior IVS for apical vault prolapse - a 2-year prospective multicenter study. American

Urogynecologic Society (27th Annual meeting). Palm Springs, California; 2006.

280. Vardy M, Zhou H, Dietrich M, Dorchak J, Naughton M, Shobeiri S, et al IVS tunneller device for apical vaginal prolapse with and without suburethral slingplasty: preliminary safety report. International Urogynecological Association (30th Annual Meeting). Copenhagen (Denmark); 2005.
281. Kairaluoma MV, Kellokumpu IH. Epidemiologic aspects of complete rectal prolapse. Scandinavian Journal of Surgery: SJS. 2005;94(3):207-10.
282. Altemeier WA, Culbertson WR, Schowengerdt C, Hunt J. Nineteen years' experience with the one-stage perineal repair of rectal prolapse. Ann Surg. 1971;173(6):993-1006.
283. Altman D, et al. Pelvic organ prolapse and urinary incontinence in women with surgically managed rectal prolapse: a population-based case-control study. Diseases of the Colon & Rectum. 2006;49(1):28-35.
284. Bachoo P, Brazzelli M, Grant A. Surgery for faecal incontinence in adults. Cochrane Database of Systematic Reviews. 2007;2:CD001757
285. Agachan F, et al. Comparison of three perineal procedures for the treatment of rectal prolapse. Southern Medical Journal. 1997;90(9):925-32.
286. Delorme E. Sur le traitment des prolapsus du rectum par l'excision de la muquese rectale au rectal-colique. . Bull Mem Soc Chir Paris. 1900;26:499-518.
287. Lechaux JP, Lechaux D, Perez M. Results of Delorme's procedure for rectal prolapse. Advantages of a modified technique. Diseases of the Colon & Rectum. 1995;38(3):301-7.
288. Marchal F, et al. Long-term results of Delorme's procedure and Orr-Loygue rectopexy to treat complete rectal prolapse. Diseases of the Colon & Rectum. 2005;48(9):1785-90.
289. Oliver GC, et al. Delorme's procedure for complete rectal prolapse in severely debilitated patients. An analysis of 41 cases. Diseases of the Colon & Rectum. 1994;37(5):461-7.
290. Tobin SA, Scott IH. Delorme operation for rectal prolapse. British Journal of Surgery. 1994;81(11):1681-4.
291. Watts AM, Thompson MR. Evaluation of Delorme's procedure as a treatment for full-thickness rectal prolapse. British Journal of Surgery. 2000;87(2):218-22.
292. Altemeier WA, Giuseffi J, Hoxworth P. Treatment of extensive prolapse of the rectum in aged and debilitated patients. Arch Surg. 1952;65:72-80.
293. Chun SW, et al. Perineal rectosigmoidectomy for rectal prolapse: role of levatorplasty. Techniques in Coloproctology. 2004;8(1):3-8; discussion -9.
294. Kim DS, et al. Complete rectal prolapse: evolution of management and results. Diseases of the Colon & Rectum. 1999;42; discussion 466-9(4):460-66.
295. Williams JG, et al. Treatment of rectal prolapse in the elderly by perineal rectosigmoidectomy. Diseases of the Colon & Rectum. 1992;35(9):830-4.
296. Zbar AP, et al. Perineal rectosigmoidectomy (Altemeier's procedure): a review of physiology, technique and outcome. Techniques in Coloproctology. 2002;6(2):109-16.
297. Deen KI, et al. Abdominal resection rectopexy with pelvic floor repair versus perineal rectosigmoidectomy and pelvic floor repair for full-thickness rectal prolapse. British Journal of Surgery 1994;81(2):302-4.
298. Benoist S, et al. Functional results two years after laparoscopic rectopexy. American Journal of Surgery. 2001;182(2):168-73.
299. Boccasanta P, et al. Comparison of laparoscopic rectopexy with open technique in the treatment of complete rectal prolapse: clinical and functional results. Surgical Laparoscopy & Endoscopy. 1998;8(6):460-5.
300. Dulucq J-L, Wintringer P, Mahajna A. Clinical and functional outcome of laparoscopic posterior rectopexy (Wells) for full-thickness rectal prolapse. A prospective study. Surgical Endoscopy. 2007;21(12):2226-30.
301. Heemskerk J, et al. Robot-assisted vs. conventional laparoscopic rectopexy for rectal prolapse: a comparative study on costs and time. Diseases of the Colon & Rectum. 2007;50(11):1825-30.
302. Hsu A, Brand MI, Saclarides TJ. Laparoscopic rectopexy without resection: a worthwhile treatment for rectal prolapse in patients without prior constipation. American Surgeon. 2007;73(9):858-61.
303. Kaiwa Y, et al. Outcome of laparoscopic rectopexy for complete rectal prolapse in patients older than 70 years versus younger patients. Surgery Today 2004;34(9):742-6.
304. Lechaux D, et al. Laparoscopic rectopexy for full-thickness rectal prolapse: a single-institution retrospective study evaluating surgical outcome. Surgical Endoscopy. 2005;19(4):514-8.
305. Zittel TT, et al Functional results after laparoscopic rectopexy for rectal prolapse. Journal of Gastrointestinal Surgery. 2000;4(6):632-41.
306. Solomon MJ, et al. Randomized clinical trial of laparoscopic versus open abdominal rectopexy for rectal prolapse. British Journal of Surgery. 2002;89(1):35-9.
307. Blatchford GJ, et al. Rectopexy without resection for rectal prolapse. American Journal of Surgery. 1989;158(6):574-6.
308. Sayfan J, et al. Sutured posterior abdominal rectopexy with sigmoidectomy compared with Marlex rectopexy for rectal prolapse. British Journal of Surgery. 1990;77(2):143-5.
309. Schultz I, et al. Long-term results and functional outcome after Ripstein rectopexy. Diseases of the Colon & Rectum. 2000;43(1):35-43.
310. Speakman CT, et al. Lateral ligament division during rectopexy causes constipation but prevents recurrence: results of a prospective randomized study. British Journal of Surgery. 1991;78(12):1431-3.
311. D'Hoore A, Cadoni R, Penninckx F. Long-term outcome of laparoscopic ventral rectopexy for total rectal prolapse. British Journal of Surgery. 2004;91(11):1500-5.
312. D'Hoore A, Penninckx F. Laparoscopic ventral recto(colpo)pexy for rectal prolapse: surgical technique and outcome for 109 patients. Surgical Endoscopy. 2006;20(12):1919-23.
313. Khanna AK, Misra MK, Kumar K. Simplified sutured sacral rectopexy for complete rectal prolapse in adults. European Journal of Surgery. 1996;162(2):143-6.
314. Yoshioka K, Heyen F, Keighley MR. Functional results after posterior abdominal rectopexy for rectal prolapse. Diseases of the Colon & Rectum. 1989;32(10):835-8.
315. Novell JR, et al. Prospective randomized trial of Ivalon sponge versus sutured rectopexy for full-thickness rectal prolapse. British Journal of Surgery. 1994;81(6):904-6.
316. Galili Y, Rabau M. Comparison of polyglycolic acid and polypropylene mesh for rectopexy in the treatment of rectal prolapse. European Journal of Surgery. 1997;163(6):445-8.
317. Winde G, et al Clinical and functional results of abdominal rectopexy with absorbable mesh-graft for treatment of complete rectal prolapse. European Journal of Surgery. 1993;159(5):301-5.

318. Ashari LHS, et al Laparoscopically-assisted resection rectopexy for rectal prolapse: ten years' experience. Diseases of the Colon & Rectum. 2005;48(5):982-7.

319. Huber FT, Stein H, Siewert JR. Functional results after treatment of rectal prolapse with rectopexy and sigmoid resection. World Journal of Surgery. 1995;19(1):138-43; discussion 43.

320. McKee RF, et al. A prospective randomized study of abdominal rectopexy with and without sigmoidectomy in rectal prolapse. Surgery, Gynecology & Obstetrics. 1992;174(2):145-8.

321. Luukkonen P, Mikkonen U, Jarvinen H. Abdominal rectopexy with sigmoidectomy vs. rectopexy alone for rectal prolapse: a prospective, randomized study. International Journal of Colorectal Disease 1992;7(4):219-22.

322. Loygue J, et al. Rectopexy to the promontory for the treatment of rectal prolapse. Report of 257 cases. Diseases of the Colon & Rectum 1984;27(6):356-9.

323. Douard R, et al. Functional results after the Orr-Loygue transabdominal rectopexy for complete rectal prolapse. Diseases of the Colon & Rectum 2003;46(8):1089-96.