Graft and Mesh Use in Transvaginal Prolapse Repair: A Systematic Review

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Abstract

OBJECTIVE: To update clinical practice guidelines on graft and mesh use in transvaginal pelvic organ prolapse repair based on systematic review.

DATA SOURCES: Eligible studies, published through April 2015, were retrieved through ClinicalTrials.gov, MEDLINE, and Cochrane databases and bibliography searches.

METHODS OF STUDY SELECTION: We included studies of transvaginal prolapse repair that compared graft or mesh use with either native tissue repair or use of a different graft or mesh with anatomic and symptomatic outcomes with a minimum of 12 months of follow-up.

TABULATION, INTEGRATION, AND RESULTS: Study data were extracted by one reviewer and confirmed by a second reviewer. Studies were classified by vaginal compartment (anterior, posterior, apical, or multiple), graft type (biologic, synthetic absorbable, synthetic nonabsorbable), and outcome (anatomic, symptomatic, sexual function, mesh complications, and return to the operating room). We found 66 comparative studies reported in 70 articles, including 38 randomized trials; quality of the literature has improved over time, but some outcomes still show heterogeneity and limited power. In the anterior vaginal compartment, synthetic nonabsorbable mesh consistently showed improved anatomic and bulge symptom outcomes compared with native tissue repairs based on meta-analyses. Other subjective outcomes, including urinary incontinence or dyspareunia, generally did not differ. Biologic graft or synthetic absorbable mesh use did not provide an advantage in any compartment. Synthetic mesh use in the posterior or apical compartments did not improve success. Mesh erosion rates ranged from 1.4–19% at the anterior vaginal wall, but 3–36% when mesh was placed in multiple compartments. Operative mesh revision rates ranged from 3–8%.

CONCLUSION: Synthetic mesh augmentation of anterior wall prolapse repair improves anatomic outcomes and bulge symptoms compared with native tissue repair. Biologic grafts do not improve prolapse repair outcomes in any compartment. Mesh erosion occurred in up to 36% of patients, but reoperation rates were low.

In 2008 the Society of Gynecologic Surgeons' Systematic Review Group published a systematic review and clinical practice guidelines on transvaginal graft and mesh use for pelvic organ prolapse (POP) repair, which noted a paucity of data.1,2 That same year, the U.S. Food and Drug Administration (FDA) issued the first safety communication regarding serious complications associated with the use of transvaginal mesh for treatment of prolapse.3 Almost 3 years later, after an increasing number of reported adverse events, the FDA issued a second safety communication.4 In 2014, the FDA mandated premarket studies to evaluate the safety and effectiveness of vaginal mesh implants and, in January 2016, reclassified them as class III high-risk devices.5 National organizations, including the American Urogynecologic Society, have subsequently published guidelines stating that placement of vaginal mesh should only be performed by experienced, knowledgeable surgeons who track their outcomes and provide rigorous informed consent.6 Since the 2008 review, the number of published studies on the use of transvaginal mesh for POP repair has increased substantially. In this update, we aimed to compare anatomic and symptomatic outcomes of graft use (both biologic and synthetic) compared with native tissue as well as between different graft materials for transvaginal POP repair. Like in the original review, we refer to biologic material as “graft” and synthetic material as “mesh.” A comprehensive review of related adverse events and their management was completed in two prior systematic reviews 1,7 and was not the focus of this update.

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SOURCES

The 2008 review included a MEDLINE search for the period between 1950 and November 27, 2007.1 We performed a search update to April 15, 2015, using the same terms as the original search and also searched MEDLINE (November 2007 to April 15, 2015) and the Cochrane Central Register of Controlled Trials and Database of Systematic Reviews (both 2007–2015). Search terms included “vaginal or uterine prolapse,” “rectocoe,” “cystocoe,,” “surgery of the pelvic floor,” “surgical mesh,” “vagina,” “rectum,” and “bladder” (search details are shown in Appendix 1, available online at http://links.lww.com/AOG/A809). The search was limited to human studies. Abstracts were manually double-screened by eight Systematic Review Group members for possible inclusion using Abstrackr software.8 Potentially eligible studies published in any language were double-screened in full text.
A search of ClinicalTrials.gov for graft or mesh prolapse studies returned 105 studies on January 11, 2016. Of those, 13 were identified in prior searches, 17 were actively being conducted, 68 did not meet our inclusion criteria, and five could not be located in any searchable database.

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**STUDY SELECTION**

To compare anatomic and symptomatic outcomes of repair with graft or mesh compared with native tissue, we included studies directly comparing transvaginal POP repair using native tissue and graft or mesh. To compare different graft or mesh materials, we included studies that directly compared one type of graft or mesh with another. Studies could include concomitant procedures (eg, an anti-incontinence sling, hysterectomy, prolapse repairs in other compartments) provided this was true in all study arms. We categorized studies based on the type of graft or mesh used and the vaginal compartment in which there was a difference between arms regarding mesh or graft placement. We included randomized controlled trials (RCTs) and prospective or retrospective longitudinal comparative studies that reported on anatomic or symptomatic outcomes with a minimum of 12 months of follow-up. The original 2008 review included studies with any length of follow-up as a result of a paucity of evidence, but with the increase in studies, we determined this restriction was warranted. Studies could report on primary, repeat, or a combination of primary and repeat repairs.

For anatomic outcomes, only studies that used either the Baden-Walker or pelvic organ prolapse quantification (POP-Q) classification methods were included. For symptomatic outcomes, we included quality of life, patient satisfaction, urinary, bowel, or both symptoms, sexual function, mesh exposure, and return to the operating room. We extracted study characteristics and outcome results at the longest reported follow-up. We did not contact study authors for additional information.

Data were extracted from each study by one reviewer and confirmed by a second reviewer. Discrepancies were resolved by discussion or by referral to a third reviewer. We assessed the methodologic quality (risk of bias) of each study based on predefined criteria using a three-category grading system (high, moderate, or poor quality) used for prior reviews by our group.11 This system takes into account risks of bias related to randomization, randomization method, allocation concealment, outcome assessor blinding, and attrition bias together with inadequate reporting of patient, surgeon, surgery, outcomes, or methodology details.

For symptomatic prolapse outcomes after anterior compartment repair, all studies that reported symptoms of a bulge postoperatively were included in meta-analyses. One meta-analysis used the total Pelvic Organ Prolapse-Distress Inventory subscale score of the Pelvic Floor Distress Inventory 12 and the other used any collected “bulge symptom” data. No study reported exclusively on the discrete question of the Pelvic Organ Prolapse-Distress Inventory pertaining to bulge symptoms, and those that only reported the total Pelvic Floor Distress Inventory score were excluded. Data from the longest follow-up point were used. Anterior compartment repair was chosen because the most studies were available for analysis. Meta-analyses were performed on the odds ratio (for categorical outcomes) or net change (for continuous outcomes) using a profile likelihood random-effects model.13 Meta-analyses were conducted with the metaan package in Stata 13.1.

We developed clinical practice guidelines incorporating the balance between benefits and harms of the compared interventions when the data were sufficient to support these statements. Each guideline statement was assigned an overall level of strength of the recommendation (1=“strong,” 2=“weak”) based on the quality of the supporting evidence and the size of the net benefit.14 The strength of a recommendation indicates the extent to which one can be confident that adherence to the recommendation will do more good than harm. The completed review and guidelines were posted online for the entire Society of Gynecologic Surgeons membership to review and provide comments on before submission.

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**RESULTS**

The initial 2008 review identified 2,260 citations.1 After abstract screening, 196 full-text articles were assessed in detail; 16 comparative studies, including six RCTs, evaluated graft use. For this review, 10 of the originally included nonrandomized studies were excluded as a result of short follow-up (less than 12 months). The updated search through April 2015 returned an additional 3,552 citations, of which 106 full-text articles were assessed in detail. In total, 66 comparative studies reported in 70 articles, including 38 RCTs, are included (Fig. 1). Studies that included three arms were evaluated as multiple two-arm comparisons. Women from these studies underwent surgery between 1989 and 2012. Study sample sizes ranged from 24 to 641. Study characteristics are provided in Appendices 2–5, available online at http://links.lww.com/AOG/A809. Clinical Practice Guidelines are in Appendix 6, available online at http://links.lww.com/AOG/A809.

Flow diagram illus...
### Outcomes in the Anterior Compartment

There were 42 comparative studies, including 26 RCTs (14 high-, nine moderate-, and three low-quality RCTs; two moderate- and 16 low-quality cohort studies), that examined anatomic and functional outcomes in the anterior vaginal compartment (Appendix 3, http://links.lww.com/AOG/A809). This was a substantial increase from the initial review, which included only 11 studies. Nine studies compared outcomes after biologic graft and native tissue, 19–28 two studies compared synthetic absorbable mesh with native tissue, 29,30 20 studies compared synthetic nonabsorbable mesh and native tissue repair, 21,26,31–50,61 and 11 studies compared a graft or mesh and another graft material, 21,26,52–60 (Appendix 3, http://links.lww.com/AOG/A809).

### Synthetic Nonabsorbable Mesh Compared With Native Tissue

One prospective cohort study (poor quality) evaluated the use of synthetic nonabsorbable mesh in the posterior vaginal compartment. 18 Anatomic failure was worse defined but occurred less often when polypropylene mesh was used to augment a transperineal levatorplasty.

### Synthetic Absorbable Mesh Compared With Native Tissue Repair

Two RCTs (moderate-quality) assessed anatomic outcomes of synthetic absorbable mesh compared with native tissue repair (Appendix 3, http://links.lww.com/AOG/A809). This was a substantial increase from the initial review, which included only 11 studies. Nine studies compared outcomes after biologic graft and native tissue, 19–28 two studies compared synthetic absorbable mesh with native tissue, 29,30 20 studies compared synthetic nonabsorbable mesh and native tissue repair, 21,26,31–50,61 and 11 studies compared a graft or mesh and another graft material, 21,26,52–60 (Appendix 3, http://links.lww.com/AOG/A809).

### Biologic Graft Compared With Native Tissue

Seven RCTs (three high-, two moderate-, two low-quality) and two retrospective cohort studies (low-quality) compared anatomic and functional outcomes (Appendix 3, http://links.lww.com/AOG/A809). Most studies showed no difference in anatomic or symptomatic outcomes such as urinary incontinence, quality of life, or sexual function after 12–24 months. In six studies, few women (1% or less) needed to return to the operating room for a graft complication.

Although most studies found no difference between groups, two RCTs showed an improved anatomic result with graft use compared with native tissue repair, 23,24,27 However, quality-of-life outcomes were not different between groups in these studies. 23,24 There was variability in biologic grafts used in these studies, including cadaveric dermis, porcine dermis, bovine pericardium, and porcine small intestine submucosa. The most common graft used in these studies, Pelvicol (porcine dermis), is no longer available in the United States. Additionally, the surgical techniques performed during implantation were heterogeneous.

### Overall for Anterior Vaginal Prolapse Repair

High-quality evidence suggests no difference in anatomic and quality-of-life outcomes when biologic grafts are used compared with native tissue repair.

### Synthetic Nonabsorbable Mesh Compared With Native Tissue

Two high-quality RCTs and one low-quality retrospective cohort study compared outcomes between a graft and native tissue repair (Appendix 2, http://links.lww.com/AOG/A809). One RCT noted significantly higher anatomic failure rates after graft-augmented repair compared with native tissue posterior colporrhaphy, 15 whereas the other found no difference between groups. 16 Both studies showed no difference for symptomatic outcomes and no graft exposures.

### Synthetic Absorbable Mesh Compared With Native Tissue Repair

Twenty studies compared synthetic efficacy and functional outcomes after synthetic nonabsorbable mesh augmentation compared with native tissue repair of the anterior compartment (Appendix 3, http://links.lww.com/AOG/A809). This was a substantial increase from the initial review, which included only 11 studies. Nine studies compared outcomes after biologic graft and native tissue, 19–28 two studies compared synthetic absorbable mesh with native tissue, 29,30 20 studies compared synthetic nonabsorbable mesh and native tissue repair, 21,26,31–50,61 and 11 studies compared a graft or mesh and another graft material, 21,26,52–60 (Appendix 3, http://links.lww.com/AOG/A809).

Two studies report on outcomes of the Gynecare Anterior Prolift, which is no longer commercially available, with similar conclusions (Appendix 3, http://links.lww.com/AOG/A809). A large study in this review, by Altman et al, 39 randomized 389 women to either a Prolift mesh kit or native tissue anterior colporrhaphy, showing that mesh improved anatomic outcomes, but pain and sexual function were not statistically different between groups.

### Biologic Graft Compared With Native Tissue

Seven RCTs (three high-, nine moderate-, and three low-quality RCTs; two moderate- and 16 low-quality cohort studies), that examined anatomic and functional outcomes in the anterior vaginal compartment (Appendix 3, http://links.lww.com/AOG/A809). Most studies showed no difference in anatomic or symptomatic outcomes such as urinary incontinence, quality of life, or sexual function after 12–24 months. In six studies, few women (1% or less) needed to return to the operating room for a graft complication.

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### Overall for Anterior Vaginal Prolapse Repair

High-quality evidence suggests no difference in anatomic and quality-of-life outcomes when biologic grafts are used compared with native tissue repair.
We were able to perform meta-analyses of bulge symptoms across studies, erosion rates generally ranged from 1.4–19%, with most of these treated in the office. Operative mesh revision rates ranged from 3–8% across studies. When reported, there were rarely significant differences between groups for overall reoperation rates.

In summary, there is high-quality evidence that the use of synthetic nonabsorbable mesh improves anatomic outcomes compared with native tissue anterior colporrhaphy. Data from meta-analyses confirm that mesh repairs also provided superior relief of subjective bulge symptoms. However, there is also high-quality evidence to suggest no difference for subjective outcomes including quality of life and urinary and sexual function.

Graft or Mesh Compared With Other Types of Graft or Mesh

Eleven comparative studies assessed anatomic efficacy between different graft or mesh materials in the anterior compartment (Appendix 3, [http://links.lww.com/AOG/A809]).21,26,52–60 These included seven cohort studies (one moderate-quality, six low-quality) and four RCTs (two high-, one moderate-, one low-quality).

In studies comparing biologic graft with synthetic nonabsorbable mesh, mesh was consistently found to have superior anatomic outcomes. 21,26,53 All three studies used self-tailored polypropylene mesh. Porcine dermis, which is no longer available in the United States, was the biologic graft used in all three studies, including two RCTs and one retrospective cohort. When subjective outcomes were reported, there were no between-group differences, except one moderate-quality study 53 that showed graft material resulted in better sexual function scores compared with mesh. That same study found a higher rate of erosion in the mesh group with no erosions in the biologic group, although all erosions were treated in the office.53

In the only study comparing biologic graft with absorbable synthetic mesh, the graft group had a higher rate of failure and there were no reported differences in subjective outcomes.52 The only study comparing two different biologic grafts showed that porcine dermis resulted in superior anatomic outcomes compared with cadaveric dermis.54 There were no significant differences in functional status, rates of urinary incontinence, new-onset urinary urgency, or dyspareunia between groups. No graft-related complications were seen.

The remaining six studies compared different kits, insertion techniques, or both for polypropylene mesh. When different trocar-based kits were compared,55 Anterior Prolift and Perigee did not show a difference for anatomic or subjective outcomes, mesh erosion, or dyspareunia rates. Perigee was found to have superior anatomic outcomes to the Anterior Elevate in a retrospective cohort study.60 Satisfaction and subjective cure rates similarly favored Perigee. Although Perigee had a higher erosion rate, the difference was not statistically significant.

In summary, the heterogeneous evidence comparing use of various grafts and mesh with each other in repair of anterior vaginal wall prolapse limits our ability to draw conclusions. Like in other comparisons, synthetic nonabsorbable mesh tends to provide superior outcomes compared with other surgical repairs.

Outcomes in the Apical Compartment

Three studies (one moderate-quality RCT, two low-quality cohort studies) looked at repair exclusively of the vaginal apex, two comparing synthetic nonabsorbable mesh with native tissue repair and one comparing two different synthetic nonabsorbable meshes with each other (Appendix 4, [http://links.lww.com/AOG/A809]).62–64 Two studies used the IVS Tunneller, which has been recalled from the market as a result of a high complication rate. No study showed any significant difference in anatomic outcomes at 17–58 months of follow-up, but the ability to draw conclusions from the few and lower quality studies in this group is limited.

Outcomes in Multiple Compartments

Sixteen trials evaluated concomitant repair of multiple vaginal compartments (Appendix 5, [http://links.lww.com/AOG/A809]).65–83 This included five high-quality and four moderate-quality RCTs and four moderate-quality and three low-quality cohort studies. With the exception of one study,67 all were published since the 2008 review.

Biologic Graft Compared With Native Tissue Repair

One low-quality cohort and one moderate-quality RCT evaluated multiple-compartment repair.65,66 Overall, there was no difference between groups for anatomic outcomes or sexual functioning (Appendix 5, [http://links.lww.com/AOG/A809]).

Synthetic Absorbable Mesh Compared With Native Tissue
A moderate-quality RCT by Sand et al 67 remains the only one to evaluate the use of synthetic absorbable mesh compared with native tissue repair in the anterior and posterior compartments (Appendix 5, http://links.lww.com/AOG/A809). At 1 year, anatomic outcomes at the anterior wall were superior with placement of polyglactin 910 mesh, but outcomes at the posterior wall did not differ.

DISCUSSION

Prolapse surgery continues to pose challenges as a result of high recurrence rates combined with the demand to perform minimally invasive vaginal surgery that also addresses quality-of-life outcomes. Based on this review, there is strong evidence to support the use of synthetic mesh at the anterior wall compared with native tissue repair for vaginal POP repair anatomically and for relief of bulge symptoms. Use of biologic grafts or synthetic mesh did not improve anatomic or subjective outcomes in any other vaginal compartment.

Since our initial review, the number and quality of comparative studies evaluating transvaginal graft and mesh use for POP repair have greatly increased. However, the majority of studies still focus on anatomic outcomes and are powered on that basis. There is improved consensus of the definition of anatomic failure as POP-Q stage 2 or greater since the last review. More studies now report subjective and functional outcomes, although they are not often adequately powered to detect differences for these outcomes.

Some caution is advisable in interpretation of the meta-analyses for subjective prolapse symptoms of the anterior vaginal wall after synthetic mesh or native tissue repair. Only 5 of 20 available studies reported subjective prolapse results specifically using the Pelvic Organ Prolapse-Distress Inventory, limiting inclusion in the meta-analysis. Our meta-analysis of “bulge symptoms” included any studies that asked about bulge symptoms postoperatively, but the verbiage was heterogeneous.

We question whether comparing native tissue anterior colporrhaphy and mesh-augmented repair is truly a similar comparison. Many mesh-based anterior compartment repairs attach the mesh to either the proximal arcus tendineus fascia pelvis or the sacrospinous ligament, whereas a traditional anterior colporrhaphy does not take advantage of this element of apical support. It remains unclear whether the mesh augmentation or the additional apical support differentiates later success. Although many of these RCTs strictly enrolled patients with anterior wall prolapse, it is an unresolved question whether stage 3 anterior wall prolapse is truly isolated from apical support defects.
The use of vaginal mesh has come under considerable federal, medicolegal, and public scrutiny in addition to improved scientific rigor. Many women continue to present with debilitating complications such as erosion, chronic pain, and dyspareunia. Surgical management may not completely resolve these symptoms, and all of these outcomes except mesh erosion can occur with any form of prolapse repair regardless of mesh or graft use. The studies in this review report relatively few serious complications with rates generally similar between groups. This may be the result of variability in reporting subjective outcomes such as pain and dyspareunia, loss to follow-up, and small study numbers. In the setting of the reported studies conducted by presumably experienced pelvic reconstructive surgeons, the rates of pain and dyspareunia show little difference between groups, but this may not be generalizable to all surgical settings. Clinical application of these results and guidelines should take this into account. There is no universal answer to what prolapse surgery to perform in a specific situation because no prolapse or patient is identical. The data reported here provide part of the picture, which also include surgeon experience, patient surgical history, desired sexual functioning, and related symptoms such as incontinence or bowel issues. We encourage surgeons to consider these factors when planning surgery as well as incorporating them into a thorough consent process.

Although the number of studies has increased since our last review, there are still few studies with long follow-up and relatively few enrolled patients, suggesting goals for future research. Most patients improve subjectively regardless of treatment option, so larger numbers of study participants need to be followed to adequately power for subjective outcomes.

The strengths of this review are its robust methodologic approach and insight from gynecologic surgeons who have prior experience at reviewing this topic. The quality of literature on this topic is growing, making the strength of practice guidelines stronger. We were able to draw data from comparative studies with at least 12 months of follow-up, including a growing number of RCTs.

Like with any systematic review, we are limited by the available literature, which in this case was heterogeneous. Currently, we are unable to comment on subpopulations of interest such as primary compared with repeat surgery, because they were not separately evaluated. Subjective outcome reporting is still heterogeneous as are data on retreatment and reoperation. Multicompartiment concomitant surgery such as vaginal hysterectomy or midurethral sling placement may also confound our conclusions.

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