**Name of journal: World Journal of Clinical Urology**

**ESPS Manuscript NO: 4444**

**Columns: Editorial**

Safety of synthetic mesh in pelvic surgery

Osborn DJ *et al.* Safety of mesh

David James Osborn, Roger Dmochowski

**David James Osborn, Roger Dmochowski,** Department of Urology, Vanderbilt University Medical Center, Nashville, TN 37232-2765, United States

**Author contributions:** Osborn DJ wrote the manuscript; Dmochowski R edited the manuscript.

**Correspondence to: David James Osborn, MD,** Department of Urology, Vanderbilt University Medical Center, A1302 Medical Center North, Nashville, TN 37232-2765, United States. david.osborn@vanderbilt.edu

**Telephone:** +1-615-3435602 **Fax**: +1-615-3228990

**Received:** June 29, 2013 **Revised:** September 13, 2013

**Accepted:** October 16, 2013

**Published online:**

**Abstract**

Mesh in the form of a midurethral sling is an acceptable and generally safe treatment option for stress urinary incontinence in patients who have failed conservative treatment options such as weight loss and pelvic floor muscle training.  In patients with pelvic organ prolapse, when outcomes are measured in terms of improvement in postoperative physical exam (anatomic success), many studies have demonstrated that mesh augmented repairs are superior to prolapse repairs not using mesh (native tissue).  However, from a symptomatic standpoint, the outcomes of mesh and native tissue repairs are equivalent.  This means that even though the physician may see more prolapse on physical exam after native tissue repair, most patients do not perceive this as a problem because their sensation of a vaginal bulge is gone.  The vaginal bulge is one of the most common complaints of a patient prior to pelvic organ prolapse repair. Based on interpretation of the available literature, it does not appear that mesh is superior to native tissue repair for anterior (cystocele) and posterior (rectocele) compartment pelvic organ prolapse repair.  However, for apical repairs the native tissue repairs are more technically challenging and it appears that suspension of the apex of the vagina with mesh to the sacrum (sacrocolpopexy) may yield better outcomes. Unfortunately, like all mesh surgeries there is a significant risk of mesh complications with sacrocolpopexy. Surgeons should thoroughly counsel their patients about the permanent nature of synthetic mesh and the potential serious complications related to its use.  Mesh augmented pelvic organ prolapse repairs carry unique complications that are not present with native tissue repairs and may not provide better outcomes.

© 2013 Baishideng. All rights reserved.

**Key words:** Complication; Prolapse; Incontinence; Sling; Prosthesis; Graft

**Core tip:** Mesh does not provide superior results to native tissue repair and has higher rates of dyspareunia and unique potential serious complications. In general, native tissue repairs are more technically challenging than mesh augmented repair and require the surgeon to have a greater understanding of the anatomy of pelvic organ support.

Osborn DJ, Dmochowski R. Safety of synthetic mesh in pelvic surgery

**Available from:**

**DOI:**

In the field of pelvic reconstruction, synthetic mesh is commonly used for the treatment of pelvic organ prolapse and stress urinary incontinence (SUI). The use of mesh during pelvic organ prolapse surgery is not more effective for symptomatic relief than native tissue repair and has unique potentially serious complications. Though mesh for stress incontinence also has unique complications, these surgeries appear to be less morbid and equally efficacious to traditional surgeries for stress urinary incontinence.

The most common complications of mesh surgery are mesh exposure and dyspareunia, and the most serious complications are perforation of organs such as the bladder, urethra and bowel. In 2010 the International Continence Society and International Urogynecological Association released a report intended to clarify and standardize the terminology related to complications from insertion of synthetic and biological materials in female pelvic floor surgery[1]. According to this report, synthetic mesh is termed a prosthesis and a biological implant is termed a graft. Mesh located in the bladder or urethra is termed a perforation and extrusion of mesh through the vagina or skin is termed exposure.

Research has shown that pelvic organ prolapse effects 2.9% of women over the age of 20 and though only 2% of women are symptomatic, women have an approximately 30 to 50% lifetime risk of developing pelvic organ prolapse[2,3]. The current prevalence of urinary incontinence in adult women in the United States is much higher than pelvic organ prolapse and is estimated to be between 47% and 51% and increasing[4,5]. Not surprisingly, the rates of surgery for urinary incontinence and pelvic organ prolapse are also increasing[6,7].

Prior to 1998, the most common surgeries for stress urinary incontinence were needle suspensions, autologous pubovaginal slings and collagen injections[8]. In 1998, the Food and Drug Administration (FDA) approved the first midurethral sling for stress urinary incontinence. Then, over the next 10 years the utilization of the midurethral sling increased almost 30 fold and multiple studies have shown its benefit over traditional surgeries for stress urinary incontinence not utilizing mesh[9,8]. However, as the utilization of synthetic mesh increased, problems with mesh exposure and perforation started to become apparent[10].

With interventions such as pelvic floor muscle training, weight loss and pessaries, the initial treatment of symptomatic pelvic organ prolapse should be conservative. When conservative measures fail, the ideal pelvic organ prolapse procedure would restore the body’s normal support structure while returning the prolapsed organ to its normal anatomic position with minimal side effects[11]. Prior to 2001, the majority of pelvic surgeons sought to achieve this ideal using native tissue repairs. However, following successful outcomes for mesh for SUI, researchers started looking at mesh to help with pelvic organ prolapse. Starting in 2001, multiple studies were published showing the benefits of mesh augmented repairs for pelvic organ prolapse[12,13]. From 2001 to 2008 mesh augmented pelvic organ prolapse repairs were commonly performed with little discussion regarding the safety of mesh. However, in October 2008, the US FDA released a public health notification (PHN) alerting the public about potential “rare” complications and problems related to transvaginal mesh for pelvic organ prolapse[14]. In 2011, the FDA modified this alert by removing the term “rare” and stating that surgical mesh does not conclusively improve outcomes over traditional non-mesh or native tissue repair[15]. Paradoxically, after the initial PHN the rate of vaginal mesh implantation increased[16].

The FDA became aware of problems related to synthetic mesh because of information contained in the MAUDE (manufacturer and user facility device experience) database. MAUDE is a database that houses medical device reports (MDRs) of adverse events submitted to the FDA by manufacturers and healthcare professionals. According to MAUDE data, in regards to midurethral slings, from 2008 to 2010 there were 1371 voluntary and involuntary self reported medical device reports of complications[17]. Bladder and urethra perforation were some of the most common reported MDR’s. Similarly high, over the same time period, there were 1503 MDRs for synthetic mesh used during pelvic organ prolapse surgery. In July 2011, the FDA released a statement that summarizes their opinion entitled “Urogynecologic Surgical Mesh: Update on the Safety and Effectiveness of Transvaginal Placement for Pelvic Organ Prolapse.”[17]

Today, polypropylene is the most commonly used type of synthetic mesh for pelvic surgery. However, surgeons have been using mesh during pelvic surgery for over 50 years. In 1955, Moore and colleagues reported their experience with a screen made from the metallic element tantalum[18]. They found a 100% anatomic cure rate with an unfortunate 40% graft exposure rate. More contemporary studies have shown a 75% to 91% cure rate and a 0% to 5.6% mesh exposure rate[12,19,20].

Polypropylene has become the most commonly implanted material because it is a monofilament with minimal tissue reactivity that can be formatted into mesh with large sized pores. The standard system for classifying mesh was proposed by Parviz Amid in 1997 and emphasizes pore size and filament type[21]. Amid classified mesh into four different categories. The ideal mesh type according to Amid is type 1 mesh. Type 1 mesh is made of a monofilament mesh loosely woven with large pores. Mesh is considered to have large pores if the open space between the fibers is greater than 75 μm. This large pore size promotes flexibility, angiogenesis and macrophage penetration[22,23]. Multifilament material can theoretically harbor and promote the growth of bacteria and result in more infection and inflammation. This problem was seen in a 2001 study by Falconer *et al*[24] that showed significantly more histological evidence of inflammation in patients with mersilene suburethral slings compared to patients with polypropylene. In addition, it seems that mesh with smaller pore sizes such as Gore-tex do not become incorporated into tissue and have a high rate of perforation or exposure[25,26].

The management of mesh exposure is within the scope of practice of most pelvic surgeons, however, mesh perforation may require tertiary referral. There are several studies that propose observing any exposure of mesh less than 1 cm because the area may heal spontaneously with mixed results[27-30]. Depending on the preference of the surgeon and the size of the exposure, the next step for intervention may be operative management. Operative management involves excision of the exposed mesh, thorough irrigation with antibiotic solution and closure of vaginal flaps. The addition of topical antibiotics and estrogen may theoretically improve tissue quality prior to surgical intervention. In a series of 48 patients who underwent partial mesh excision, only 6 had persistent exposure[29].

Perforation of mesh slings into the urethra or bladder should be managed with more extensive mesh excision to the level of the pubic bone or ischiopubic rami. This type of excision leaves behind the arms of the mesh that tunnel into the retropubic space or obturator fossa. It is typically not necessary to enter these spaces because the mesh at this location is no longer under tension and is far from the urethra or bladder. The authors prefer an inverted-U incision because this allows for a vaginal epithelial flap that avoids overlapping suture lines and should decrease the risk of a fistula. In general, reconstruction should involve non-overlapping suture lines and interposition of tissue such as a labial fat pad, greater omentum or autologous fascial sling. In rare cases of mesh complications from slings, when non-operative therapy has failed, such as extreme pain or infection it may be necessary to attempt a complete mesh excision from both sides of the bone. In the case of retropubic slings this involves an abdominal and vaginal incision and in the case of the tans-obturator slings this involves a medial thigh and vaginal incision.

If mesh placed to augment pelvic organ prolapse repair perforates into the bladder or urethra, this is usually best managed with a midline incision and raising flaps of vaginal epithelium. Similar to mesh perforation from slings, prolapse mesh perforation should also be managed with non-overlapping suture lines and interposition of another tissue. Unlike slings, it is often difficult to remove all of the prolapse repair mesh to the level of the pubic bone and ischiopubic rami. The authors attempt to remove the mesh as far away from the bladder or urethra closure as possible and try to avoid tension on any suture lines.

Ranging from 2.7% to 5.7% in the literature, vaginal exposure rates are relatively high with midurethral slings[31,32]. The rate of bladder or urethral perforation with a trocar at the time of surgery is as high as 5.3% and 5.4%[32,33]. Though widely reported, the rate of mesh perforation into the bladder or urethra during midurethral sling surgery is unclear and ranges from 0.6% to 0.75% in the literature[34,35]. Ranging from 3% to 20%, dyspareunia and worsened sexual function are common after midurethral sling surgery[36,37]. The traditional non-mesh repairs for stress urinary incontinence are autologous pubovaginal slings and burch colposuspension. These two procedures are similarly efficacious to midurethral slings, but, have complication rates requiring surgical intervention as high as 13% and 20% in randomized clinical trials[38]. The rates of dyspareunia and sexual dysfunction after a pubovaginal sling and bladder neck suspension in the literature are lower than midurethral slings[39,40]. In another multicenter randomized clinical trial comparing bladder neck suspension to midurethral slings, the former was found to have more postoperative complications and longer recovery with equal efficacy[9].

Mesh exposure rates of synthetic mesh for pelvic organ prolapse range from 0% to 16.9%[12,19,41,42]. Dyspareunia rates after prolapse repair with mesh are as high as 20% with anterior mesh and 63% with posterior mesh[43]. However, a thorough Cochrane review of surgical management of pelvic organ prolapse from 2011 found that mesh repair and native tissue repair had similar rates of dyspareunia[44]. Mesh perforation rates are as high as 0.7%[45]. *De novo* SUI may be more common after mesh POP repair than native tissue repair[46]. Due to concerns about dyspareunia and efficacy, some surgeons advise against the use of synthetic mesh in the posterior compartment and mesh augmentation does not improve outcomes[47]. The lack of benefit from graft use in the posterior compartment might be due to the durable nature of the fascia in the posterior compartment. Abdominal sacral colpopexy with mesh has a lower complication rate than transvaginal apical support surgeries utilizing mesh[48].

When comparing the outcomes of native tissue repair and mesh-augmented repairs using anatomical results only, mesh surgeries have better outcomes[12,49]. However, when focusing on patient reported symptomatic outcomes, the difference between native tissue repair and the use of mesh is minimal[13,28,42]. An analysis of the data from the CARE trial in 2009 found that the absence of vaginal bulge symptoms had the strongest correlation with patient perception of treatment success[50].

It does not appear that transvaginal mesh for pelvic organ prolapse provides more symptomatic benefit than native tissue repair and has common, unique potentially serious complications that are not present with native tissue repair. Unlike mesh for pelvic organ prolapse, mesh with midurethral slings has similar efficacy with less overall morbidity than needle suspensions and pubovaginal slings for SUI. The current perception of many patients is that mesh for vaginal prolapse is a safety concern. Even if future literature demonstrates the safety of transvaginal mesh, some patients may still be reluctant to have foreign material placed in their bodies. Therefore, physicians may need to return to a time when native tissue repairs were more common. Lastly, a reevaluation of how we define a successful outcome may be necessary as many surgeons move away from the use of mesh for pelvic organ prolapse.

**REFERENCES**

1 Haylen BT, Freeman RM, Swift SE, Cossono M, Davila GW, Depresto J, Dwyer PL, Fatton B, Kocjancico E, Lee J, Maher C, Petri E, Rizk DE, Sand PK, Schaer GN, Webb R. IUGA/ICS Joint Terminology and Classification of Complications Related Directly to the Insertion of Prostheses (Meshes, Implants, Tapes) or Grafts In Female Pelvic Floor Surgery. Available at: http: //www.ics.org/complication, accessed June 17, 2013

2 **Samuelsson EC**, Victor FT, Tibblin G, Svärdsudd KF. Signs of genital prolapse in a Swedish population of women 20 to 59 years of age and possible related factors. *Am J Obstet Gynecol* 1999; **180**: 299-305 [PMID: 9988790 DOI: 10.1016/S0002-9378(99)70203-6]

3 **Nygaard I**, Barber MD, Burgio KL, Kenton K, Meikle S, Schaffer J, Spino C, Whitehead WE, Wu J, Brody DJ. Prevalence of symptomatic pelvic floor disorders in US women. *JAMA* 2008; **300**: 1311-1316 [PMID: 18799443 DOI: 10.1001/jama.300.11.1311]

4 **Markland AD**, Richter HE, Fwu CW, Eggers P, Kusek JW. Prevalence and trends of urinary incontinence in adults in the United States, 2001 to 2008. *J Urol* 2011; **186**: 589-593 [PMID: 21684555 DOI: 10.1016/j.juro.2011.03.114]

5 **Waetjen LE**, Liao S, Johnson WO, Sampselle CM, Sternfield B, Harlow SD, Gold EB. Factors associated with prevalent and incident urinary incontinence in a cohort of midlife women: a longitudinal analysis of data: study of women's health across the nation. *Am J Epidemiol* 2007; **165**: 309-318 [PMID: 17132698]

6 **Rogo-Gupta L**, Litwin MS, Saigal CS, Anger JT. Trends in the surgical management of stress urinary incontinence among female Medicare beneficiaries, 2002-2007. *Urology* 2013; **82**: 38-41 [PMID: 23706251 DOI: 10.1016/j.urology.2012.10.087]

7 **Wu JM**, Kawasaki A, Hundley AF, Dieter AA, Myers ER, Sung VW. Predicting the number of women who will undergo incontinence and prolapse surgery, 2010 to 2050. *Am J Obstet Gynecol* 2011; **205**: 230.e1-230.e5 [PMID: 21600549 DOI: 10.1016/j.ajog.2011.03.046]

8 **Jonsson Funk M**, Levin PJ, Wu JM. Trends in the surgical management of stress urinary incontinence. *Obstet Gynecol* 2012; **119**: 845-851 [PMID: 22433349 DOI: 10.1097/AOG.0b013e31824b2e3e]

9 **Ward K**, Hilton P. Prospective multicentre randomised trial of tension-free vaginal tape and colposuspension as primary treatment for stress incontinence. *BMJ* 2002; **325**: 67 [PMID: 12114234 DOI: 10.1136/bmj.325.7355.67]

10 **Novara G**, Galfano A, Boscolo-Berto R, Secco S, Cavalleri S, Ficarra V, Artibani W. Complication rates of tension-free midurethral slings in the treatment of female stress urinary incontinence: a systematic review and meta-analysis of randomized controlled trials comparing tension-free midurethral tapes to other surgical procedures and different devices. *Eur Urol* 2008; **53**: 288-308 [PMID: 18031923 DOI: 10.1016/j.eururo.2007.10.073]

11 **Subak LL**, Richter HE, Hunskaar S. Obesity and urinary incontinence: epidemiology and clinical research update. *J Urol* 2009; **182**: S2-S7 [PMID: 19846133 DOI: 10.1016/j.juro.2009.08.071]

12 **Sand PK**, Koduri S, Lobel RW, Winkler HA, Tomezsko J, Culligan PJ, Goldberg R. Prospective randomized trial of polyglactin 910 mesh to prevent recurrence of cystoceles and rectoceles. *Am J Obstet Gynecol* 2001; **184**: 1357-162; discussion 1357-162; [PMID: 11408853 DOI: 10.1067/mob.2001.115118]

13 **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; discussion 1304-6 [PMID: 11744900 DOI: 10.1067/mob.2001.119081]

14 FDA Public Health Notification. Serious Complications Associated with Transvaginal Placement of Surgical Mesh in Repair of Pelvic Organ Prolapse and Stress Urinary Incontinence. Food and Drug Administration Available at: http: //www.fda.gov/MedicalDevices/Safety/AlertsandNotices/PublicHealthNotifications/ucm061976.htm, accessed June 21, 2013

15 FDA Safety Communication. UPDATE on Serious Complications Associated with Transvaginal Placement of Surgical Mesh for Pelvic Organ Prolapse. Food and Drug Administration Available at: http: //www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm262435.htm, accessed June 21, 2013

16 **Reynolds WS**, Gold KP, Ni S, Kaufman MR, Dmochowski RR, Penson DF. Immediate effects of the initial FDA notification on the use of surgical mesh for pelvic organ prolapse surgery in medicare beneficiaries. *Neurourol Urodyn* 2013; **32**: 330-335 [PMID: 23001605 DOI: 10.1002/nau.22318]

17 FDA ed: Urogynecologic Surgical Mesh: Update on the Safety and Effectiveness of Transvaginal Placement for Pelvic Organ Prolapse. Available at: http://www.fda.gov/downloads/MedicalDevices/Safety/AlertsandNotices/UCM262760.pdf, accessed June 20, 2013

18 **MOORE J**, ARMSTRONG JT, WILLIS SH. The use of tantalum mesh in cystocele with critical report of ten cases. *Am J Obstet Gynecol* 1955; **69**: 1127-1135 [PMID: 14361539]

19 **Carey M**, Higgs P, Goh J, Lim J, Leong A, Krause H, Cornish A. Vaginal repair with mesh versus colporrhaphy for prolapse: a randomised controlled trial. *BJOG* 2009; **116**: 1380-1386 [PMID: 19583714 DOI: 10.1111/j.1471-0528.2009.02254.x]

20 **Groutz A**, Chaikin DC, Theusen E, Blaivas JG. Use of cadaveric solvent-dehydrated fascia lata for cystocele repair--preliminary results. *Urology* 2001; **58**: 179-183 [PMID: 11489693 DOI: 10.1016/S0090-4295(01)01177-3]

21 Amid PK. Classification of biomaterials and their related complications in abdominal wall hernia surgery. Hernia 1997. http: //link.springer.com/article/10.1007/BF02426382

22 **Dwyer PL**. Evolution of biological and synthetic grafts in reconstructive pelvic surgery. *Int Urogynecol J Pelvic Floor Dysfunct* 2006; **17 Suppl 1**: S10-S15 [PMID: 16738742 DOI: 10.1007/s00192-006-0103-0]

23 **Deprest J**, Zheng F, Konstantinovic M, Spelzini F, Claerhout F, Steensma A, Ozog Y, De Ridder D. The biology behind fascial defects and the use of implants in pelvic organ prolapse repair. *Int Urogynecol J Pelvic Floor Dysfunct* 2006; **17 Suppl 1**: S16-S25 [PMID: 16738743 DOI: 10.1007/s00192-006-0101-2]

24 **Falconer C**, Söderberg M, Blomgren B, Ulmsten U. Influence of different sling materials on connective tissue metabolism in stress urinary incontinent women. *Int Urogynecol J Pelvic Floor Dysfunct* 2001; **12 Suppl 2**: S19-S23 [PMID: 11450975 DOI: 10.1007/s001920170007]

25 **Thompson PK,** Pugmire JE and Sangi-Haghpeykar H: Abdominal Sacrocolpopexy Utilizing Gore-Tex in Genital Prolapse: Unresolved Issues. *Female Pelvic Med Reconstr Surg* 2004; 10

26 **Cundiff GW**, Varner E, Visco AG, Zyczynski HM, Nager CW, Norton PA, Schaffer J, Brown MB, Brubaker L. Risk factors for mesh/suture erosion following sacral colpopexy. *Am J Obstet Gynecol* 2008; **199**: 688.e1-688.e5 [PMID: 18976976 DOI: 10.1016/j.ajog.2008.07.029]

27 **Huang KH**, Kung FT, Liang HM, Chang SY. Management of polypropylene mesh erosion after intravaginal midurethral sling operation for female stress urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct* 2005; **16**: 437-440 [PMID: 15654499 DOI: 10.1007/s00192-004-1275-0]

28 **Nieminen K**, Hiltunen R, Takala T, Heiskanen E, Merikari M, Niemi K, Heinonen PK. Outcomes after anterior vaginal wall repair with mesh: a randomized, controlled trial with a 3 year follow-up. *Am J Obstet Gynecol* 2010; **203**: 235.e1-235.e8 [PMID: 20494332 DOI: 10.1007/s00192-013-2092-0]

29 **Tijdink MM**, Vierhout ME, Heesakkers JP, Withagen MI. Surgical management of mesh-related complications after prior pelvic floor reconstructive surgery with mesh. *Int Urogynecol J* 2011; **22**: 1395-1404 [PMID: 21681595 DOI: 10.1007/s00192-011-1476-2]

30 **Kobashi KC,** Govier FE. Management of vaginal erosion of polypropylene mesh slings. *J Urol* 2003; **169:** 2242–2243 [PMID: 12771759 DOI: 10.1097/01.ju.0000060119.43064.f6]

31 **Paraiso MF**, Walters MD, Karram MM, Barber MD. Laparoscopic Burch colposuspension versus tension-free vaginal tape: a randomized trial. *Obstet Gynecol* 2004; **104**: 1249-1258 [PMID: 15572485 DOI: 10.1097/01.AOG.0000146290.10472.b3]

32 **Richter HE**, Albo ME, Zyczynski HM, Kenton K, Norton PA, Sirls LT, Kraus SR, Chai TC, Lemack GE, Dandreo KJ, Varner RE, Menefee S, Ghetti C, Brubaker L, Nygaard I, Khandwala S, Rozanski TA, Johnson H, Schaffer J, Stoddard AM, Holley RL, Nager CW, Moalli P, Mueller E, Arisco AM, Corton M, Tennstedt S, Chang TD, Gormley EA, Litman HJ. Retropubic versus transobturator midurethral slings for stress incontinence. *N Engl J Med* 2010; **362**: 2066-2076 [PMID: 20479459 DOI: 10.1056/NEJMoa0912658]

33 **Pushkar DY**, Godunov BN, Gvozdev M, Kasyan GR. Complications of mid-urethral slings for treatment of stress urinary incontinence. *Int J Gynaecol Obstet* 2011; **113**: 54-57 [PMID: 21315346 DOI: 10.1016/j.ijgo.2010.10.024]

34 **Kuuva N**, Nilsson CG. A nationwide analysis of complications associated with the tension-free vaginal tape (TVT) procedure. *Acta Obstet Gynecol Scand* 2002; **81**: 72-77 [PMID: 11942891 DOI: 10.1034/j.1600-0412.2002.810113.x]

35 **Hammad FT**, Kennedy-Smith A, Robinson RG. Erosions and urinary retention following polypropylene synthetic sling: Australasian survey. *Eur Urol* 2005; **47**: 641-66; discussion 641-66; [PMID: 15826756 DOI: 10.1016/j.eururo.2004.11.019]

36 **Stav K**, Dwyer PL, Rosamilia A, Schierlitz L, Lim YN, Lee J. Risk factors of treatment failure of midurethral sling procedures for women with urinary stress incontinence. *Int Urogynecol J* 2010; **21**: 149-155 [PMID: 19855914 DOI: 10.1007/s00192-009-1020-9]

37 **Mazouni C**, Karsenty G, Bretelle F, Bladou F, Gamerre M, Serment G. Urinary complications and sexual function after the tension-free vaginal tape procedure. *Acta Obstet Gynecol Scand* 2004; **83**: 955-961 [PMID: 15453893 DOI: 10.1111/j.0001-6349.2004.00524.x]

38 **Albo ME**, Richter HE, Brubaker L, Norton P, Kraus SR, Zimmern PE, Chai TC, Zyczynski H, Diokno AC, Tennstedt S, Nager C, Lloyd LK, FitzGerald M, Lemack GE, Johnson HW, Leng W, Mallett V, Stoddard AM, Menefee S, Varner RE, Kenton K, Moalli P, Sirls L, Dandreo KJ, Kusek JW, Nyberg LM, Steers W. Burch colposuspension versus fascial sling to reduce urinary stress incontinence. *N Engl J Med* 2007; **356**: 2143-2155 [PMID: 17517855]

39 **Wright EJ**, Iselin CE, Carr LK, Webster GD. Pubovaginal sling using cadaveric allograft fascia for the treatment of intrinsic sphincter deficiency. *J Urol* 1998; **160**: 759-762 [PMID: 9720541 DOI: 10.1016/S0022-5347(01)62779-4]

40 **Demirci F**, Yucel O. Comparison of pubovaginal sling and burch colposuspension procedures in type I/II genuine stress incontinence. *Arch Gynecol Obstet* 2001; **265**: 190-194 [PMID: 11789743 DOI: 10.1007/s004040000159]

41 **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 Urogynecol J Pelvic Floor Dysfunct* 2007; **18**: 743-752 [PMID: 17131170 DOI: 10.1007/s00192-006-0234-3]

42 **Withagen MI**, Milani AL, den Boon J, Vervest HA, Vierhout ME. Trocar-guided mesh compared with conventional vaginal repair in recurrent prolapse: a randomized controlled trial. *Obstet Gynecol* 2011; **117**: 242-250 [PMID: 21252735 DOI: 10.1097/AOG.0b013e318203e6a5]

43 **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* 2005; **112**: 107-111 [PMID: 15663408 DOI: 10.1111/j.1471-0528.2004.00332.x]

44 **Maher CM**, Feiner B, Baessler K, Glazener CM. Surgical management of pelvic organ prolapse in women: the updated summary version Cochrane review. *Int Urogynecol J* 2011; **22**: 1445-1457 [PMID: 21927941 DOI: 10.1007/s00192-011-1542-9]

45 **Caquant F**, Collinet P, Debodinance P, Berrocal J, Garbin O, Rosenthal C, Clave H, Villet R, Jacquetin B, Cosson M. Safety of Trans Vaginal Mesh procedure: retrospective study of 684 patients. *J Obstet Gynaecol Res* 2008; **34**: 449-456 [PMID: 18937698 DOI: 10.1111/j.1447-0756.2008.00820.x]

46 **Altman D**, Väyrynen T, Engh ME, Axelsen S, Falconer C. Anterior colporrhaphy versus transvaginal mesh for pelvic-organ prolapse. *N Engl J Med* 2011; **364**: 1826-1836 [PMID: 21561348 DOI: 10.1056/NEJMoa1009521]

47 **Grimes CL**, Tan-Kim J, Whitcomb EL, Lukacz ES, Menefee SA. Long-term outcomes after native tissue vs. biological graft-augmented repair in the posterior compartment. *Int Urogynecol J* 2012; **23**: 597-604 [PMID: 22113260 DOI: 10.1007/s00192-011-1607-9]

48 **Maher C**, Baessler K, Glazener CM, Adams EJ, Hagen S. Surgical management of pelvic organ prolapse in women: a short version Cochrane review. *Neurourol Urodyn* 2008; **27**: 3-12 [PMID: 18092333 DOI: 10.1002/nau.20542]

49 **Nguyen JN**, Burchette RJ. Outcome after anterior vaginal prolapse repair: a randomized controlled trial. *Obstet Gynecol* 2008; **111**: 891-898 [PMID: 18378748 DOI: 10.1097/AOG.0b013e31816a2489]

50 **Barber MD**, Brubaker L, Nygaard I, Wheeler TL, Schaffer J, Chen Z, Spino C. Defining success after surgery for pelvic organ prolapse. *Obstet Gynecol* 2009; **114**: 600-609 [PMID: 19701041 DOI: 10.1097/AOG.0b013e3181b2b1ae]

**P-Reviewers** Ferriero M, Marinkovic SP **S-Editor** Song XX **L-Editor E-Editor**