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Bilateral round ligament suspension (RLS) of the vaginal vault during total abdominal hysterectomy (TAH) or total laparoscopic hysterectomy (TLH) to prevent post hysterectomy vault prolapse (PHVP) – an innovative surgical technique

Abstract

Post Hysterectomy Vault Prolapse (PHVP) could happen in 0.2 to 43%. More recently, PHVP has been reported in 11.6% of hysterectomies performed for prolapse and 1.8% for other benign diseases. The frequency of PHVP requiring surgery is between 6-8%. The surgical repairs are effective, however, these are technically complex and are associated with substantial morbidity. Uterosacral and Cardinal Ligaments Suspensions ULS and CLS during abdominal hysterectomy have been suggested to prevent PHVP. Round Ligament Suspension (RLS) of the vaginal vault during abdominal hysterectomy might be useful to prevent PHVP as an alternative/adjunct to ULS and CLS.

N.B. The idea was originally conceived by the author in 1992.

Keywords: PHVP prevention, round ligament vault suspension, RLS

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Abbreviations: RLS, round ligament suspension; TLH, total laparoscopic hysterectomy; TAH, total abdominal hysterectomy; PHVP, post hysterectomy vault prolapse; ICS, International continence society; POP-Q, pelvic organ prolapse quantification; OR, odds ratio; CI, confidence interval

Introduction

Post Hysterectomy Vault Prolapse (PHVP) could happen in 0.2 to 43% of hysterectomies.[1–4] More recently, PHVP has been reported to follow 11.6% of hysterectomies performed for prolapse and 1.8% for other benign diseases.[5] Although the incidence of PHVP following abdominal hysterectomy is lower than that of hysterectomies performed for prolapse, it is associated with substantial effects on the quality of life of the women and morbidity in relation to its surgical treatment. The other important issue is that it has occurred in the women who did not have prolapse or at least were not suffering from its symptoms prior to the abdominal hysterectomy. The treatment of PHVP includes surgery, pessary or pelvic floor muscle training.[6] A large study from Austria estimated the frequency of PHVP requiring surgical repair to be between 6-8%.[7] The surgical repairs are effective, however, these are technically complex and are associated with substantial morbidity. It does increase the already heavy workload of the Urogynecologists further. With the substantial increase in the number of ageing women, the workload of the Urogynecologists has been increasing and is likely to get worse. Therefore, any procedure that might reduce the incidence of PHVP would be useful.

The International Continence Society (ICS) defines PHVP as the descent of the vaginal cuff scar below a point that is 2cm less than the total vaginal length above the plane of the hymen.[8] The vaginal cuff scar corresponds to point C on the Pelvic Organ Prolapse Quantification (POP-Q) grid.[9]

PHVP may occur when the structures that support the top of the vaginal vault are not reattached at the time of the initial procedure or due to weakness of these supports over time. The risk factors for PHVP includes preoperative prolapse [Odds Ratio (OR) 6.6; 95% Confidence Interval (CI) 1.5-28.4], obesity (P<0.001) and sexual activity (OR 1.3; 95% CI 1.0-1.5). Vaginal hysterectomy is not a risk factor when preoperative prolapse is taken into account (OR 0.9; 95% CI 0.5-1.8). Obesity has been reported as the primary risk factor for PHVP following abdominal hysterectomy.[5,10] Lukanovic A et al.[11] reported that the incidence of vaginal prolapse after hysterectomy was significantly higher in women with a higher number of vaginal deliveries, more difficult deliveries, fewer Caesareans, complications after hysterectomy, heavy physical work, neurological disease, hysterectomy for pelvic organ prolapse and/or a family history of pelvic organ prolapse. Premenopausal women had surgery for PHVP an average of 16 years after hysterectomy and postmenopausal women 7 years post hysterectomy.[11]

The case load

Data from the UK suggest a hysterectomy rate of 42/100,000 population, with higher-rates in the United States (143/100,000) and Canada (108/100,000). Countries with no waiting times for surgery have even higher-rates, with Germany reporting rates of 236/100,000 and Australia 165/100,000. The total number of hysterectomies performed in UK NHS hospitals in 2011/2012 was 56,976. Of this, at least 35,396 were abdominal hysterectomies and at least 18,154 were vaginal hysterectomies. The reason for the possible disparity is that it is not possible to break down the overall figure for Scotland, which accounted for 3,426 hysterectomies.[12] At an incidence rate of 1.8%, the approximate number of PHVP generated from 35,396 abdominal hysterectomies per year would be about 637. In countries, where the rate and number of abdominal hysterectomies are higher, the number of PHVP would be higher as well.

Surgical treatment of PHVP

The surgical procedures to treat PHVP include vaginal procedures e.g. sacrospinous fixation, high uterosacral suspension, trans vaginal

mesh, colpocleisis, and abdominal procedure e.g. sacrocolpopexy that could by done as either open or laparoscopic/robotic procedure. These are effective procedures; however, all of them are associated with significant morbidity. Therefore, a preventive procedure undertaken during abdominal hysterectomy would be beneficial.[13–41]

Prevention of PHVP following abdominal hysterectomy

Uterosacral ligament suspension, cardinal ligament suspension, Modified McCall culdoplasty etc during abdominal hysterectomy have been suggested to prevent subsequent vault prolapse. These are effective procedures in preventing PHVP. There is no evidence to support the role of subtotal hysterectomy in preventing PHVP.[42–47]

Description of round ligament suspension of the vaginal vault

During abdominal hysterectomy ± bilateral salpingo-oophorectomy (including laparoscopic total hysterectomy) the round ligaments are divided at about 3 cm from the uterine cornu to keep their lengths adequate. Following hysterectomy, once the vaginal vault is closed, the ends of the round ligaments are attached to the ipsilateral angles of the vaginal vault by No 1 PDS (Polydioxanone II ©Ethicon, US) to suspend the vaginal vault without too much tension. The lengths of the round ligaments on each side should be kept at almost same length so that the vaginal vault is suspended symmetrically to reduce the chance of unequal distribution of traction exerted by the vaginal vault on the round ligaments (Figure 1).

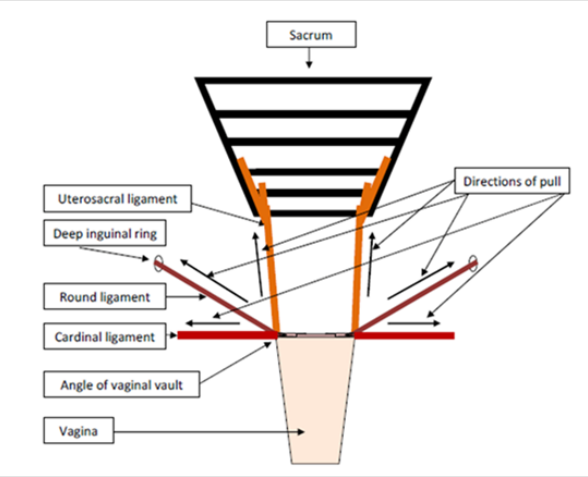

Figure 1 Schematic diagram of round ligament suspension (RLS), uterosacral ligament suspension (ULS) and cardinal ligament suspension (CLS) of the vaginal vault showing the different directions of pull.

RLS: The round ligaments attached to the angles of the vaginal vault would pull the vault upwards and laterally on both sides in almost opposite directions. ULS: The uterosacral ligaments attached to the angles of the vaginal vault would pull the vault backwards in almost same direction. CLS: The cardinal ligaments attached to the angles of the vaginal vault would pull the vault laterally on both sides in opposite directions.

Why Round ligament suspension of the vaginal vault

i. It is easily accessible and available following abdominal hysterectomy.

ii. Its attachment to the angles of the vaginal vault would pull the vault upwards and laterally on both sides. It is important to attach the round ligaments to the angles of the vaginal vault to distribute the vector force applied by the vaginal vault on each round ligament rather than anchoring them together to the centre of the vaginal vault (Figure 1). The latter would disproportionately increase the vector force applied by the vaginal vault on each round ligament. For example, the vector force on each round ligament will be 100% of the pull/weight of the vaginal vault if the round ligaments were anchored together to a single point at the centre of the vaginal vault at an angle of 120° between the round ligaments.[47]

iii. Its attachment to the vault adds only up to 1-2 minutes to the operating time.

iv. It is technically a simple procedure. In contrast to uterosacral ligament suspension the risk of ureteric injury would be very unlikely.[48]

v. The main criticism regarding the use of round ligaments for vaginal vault suspension has been that these are relatively weaker than the uterosacral ligaments. A recent biomedical study on their relative strengths revealed that the round ligaments demonstrated stiffness of 9.1±1.6 MPa (mean±SEM) (ranging from 2 to 25.6 MPa) and maximum stress of 4.3±0.7MPa (ranging from 1.2 to 11.5MPa). The stiffness of the uterosacral ligaments was 14.1±1.4MPa (ranging from 5.7 to 26.1MPa) with maximum stress of 6.3±0.8MPa (ranging from 2.2 to 11.9MPa). There was a strong positive correlation between stiffness and maximum stress in female pelvic ligaments (ρ=0.851; $p<0.001$). The uterosacral ligaments demonstrated higher stiffness (about 55% greater) and maximum stress (about 47% greater) compared to the round ligaments but the differences were statistically not significant (p=0.006 and p=0.034 respectively). Age, body mass index and menopausal status were not associated with the biomechanical properties of round and uterosacral ligaments. Compared to parous women, nulliparous women had lower uterosacral stiffness (15.5±1.3 vs. 10±1.8MPa; p=0.033) and maximum stress (8.2±0.9 vs. 4.2±1.1MPa; p=0.028). Parturition seems to enhance the stiffness and maximum stress of the ligaments. Interestingly, the uterosacral stiffness and maximum stress in the nulliparous women were similar to the overall average (nulliparous plus multiparous women) of that of the round ligaments.[49] Compared with the uterosacral ligaments the cardinal ligaments have greater stiffness.[50,51] Round ligaments, although generally weaker than the uterosacral and cardinal ligaments, might not be completely useless.

vi. The direction of the pull on the vaginal vault by the round ligaments would be almost in opposite directions to each other. It might have an added advantage in distributing the pull/weight exerted by the vaginal vault compared to the direction of the pull on the vaginal vault by the uterosacral ligaments in uterosacral suspension that would be almost in the same direction. Using round ligament suspension as an adjunct to uterosacral suspension might be more effective as the pull/weight exerted by the vaginal vault would be distributed in between 4 ligaments in at least three different directions. Adding cardinal ligament suspension to these would distribute the pull/weight exerted by the vaginal vault in between 6 ligaments in at least five different directions with potentially greater success (Figure 1).

Conclusion

Round ligament suspension of the vaginal vault during abdominal hysterectomy might be a simple and useful procedure to prevent

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subsequent vault prolapse. It could be used as a separate procedure or as an adjunct to uterosacral and cardinal ligaments suspensions.

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None.

Conflicts of interest

The authors declare there is no conflict of interests.

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References

1. Symmonds RE, Pratt JH. Vaginal prolapse following hysterectomy. *Am J Obstet Gynecol*. 1960;79:899–909.
2. Barrington JW, Edwards G. Posthysterectomy vault prolapse. *G Int Urogynecol J*. 2000;11(4):241–245.
3. Cruikshank SH, Kovac SR. Randomized comparison of three surgical methods used at the time of vaginal hysterectomy to prevent posterior enterocele. *Am J Obstet Gynecol*. 1999;180(4):859–865.
4. Hobson PT, Boos K, Cardozo L. Management of vaginal vault prolapse. *Br J Obstet Gynaecol*. 1998;105(1):13–17.
5. Marchionni M, Bracco GL, Checcucci V, et al. True incidence of vaginal vault prolapse. Thirteen years of experience. *J Reprod Med*. 1999;44(8):679–684.
6. Hagen S, Stark D, Glazener C, et al. Individualized pelvic floor muscle training in women with pelvic organ prolapse (POPPY):a multicentre randomised controlled trial. *Lancet*. 2014;383(9919):796–806.
7. Aigmueller T, Dungl A, Hinterholzer S, et al. An estimation of the frequency of surgery for post hysterectomy vault prolapse. *Int Urogynecol J*. 2010;21(3):299–302.
8. Abrams P, Cardozo L, Fall M, et al. The standardization of terminology of lower urinary tract function:report from the Standardisation Sub–committee of the International Continence Society. *Neurourol Urodyn*. 2002;21(2):167–178.
9. Bump RC, Mattiasson A, Bø K, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. *Am J Obstet Gynecol*. 1996;175(1):10–17.
10. Dällenbach P, Gambirasio IK, Jacob S, et al. Incidence rate and risk factors for vaginal vault prolapse repair after hysterectomy. *Int Urogynecol J Pelvic Floor Dysfunct*. 2008;19(12):1623–1629.
11. Lukanovic A, Drazic K. Risk factors for vaginal prolapse after hysterectomy. *Int J Gynaecol Obstet*. 2010;110(1):27–30.
12. Mukhopadhaya N, Manyonda IT. The hysterectomy story in the United Kingdom. *J Midlife Health*. 2013;4(1):40–41.
13. Nygaard I, Brubaker L, Zyczynski HM, et al. Long–term outcomes following abdominal sacrocolpopexy for pelvic organ prolapse. *JAMA*. 2013;309(19):2016–2024.
14. Brubaker L, Glazener C, Jacquetin B, et al. Surgery for pelvic organ prolapse. In: Abrams P, editor. Incontinence: 4th International Consultation on Incontinence. 4th edn. Paris, France: Health Publication Ltd; 2009:1273–1320.
15. Nygaard IE, McCreery R, Brubaker L, et al. Pelvic Floor Disorders Network. Abdominal sacrocolpopexy:a comprehensive review. *Obstet Gynecol*. 2004;104(4):805–823.
16. Sze EH, Karram MM. Transvaginal repair of vault prolapse:a review. *Obstet Gynecol*. 1977;89(3):466–475.
17. Beer M, Kuhn A. Surgical techniques for vault prolapse:a review of the literature. *Eur J Obstet Gynecol Reprod Biol*. 2005;119(2):144–155.
18. Morgan DM, Rogers MA, Huebner M, et al. Heterogeneity in anatomic outcome of sacrospinous ligament fixation for prolapse:a systematic review. *Obstet Gynecol*. 2007;109(6):1424–1433.
19. Cvach K, Dwyer P. Surgical management of pelvic organ prolapse:abdominal and vaginal approaches. *World J Urol*. 20112;30(4):471–477.
20. Holley RL, Varner RE, Gleason BP, et al. Recurrent pelvic support defects after sacrospinous ligament fixation for vaginal vault prolapse. *J Am Coll Surg*. 1995;180(4):444–448.
21. Dietz V, Huisman M, De Jong JM, et al. Functional outcome after sacrospinous hysteropexy for uterine descensus. *Int Urogynecol J Pelvic Floor Dysfunct*. 2008;19(6):747–752.
22. Faber VJ, Vaart HCV, Heggelman BG, et al. Serious complication 1 year after sacrospinous ligament fixation. *Int Urogynecol J Pelvic Floor Dysfunct*. 2008;19(9):1311–1313.
23. Possover M, Lemos N. Risks, symptoms, and management of pelvic nerve damage secondary to surgery for pelvic organ prolapse:a report of 95 cases. *Int Urogynecol J*. 2011;22(12):1485–1490.
24. Alevizon SJ, Finan MA. Sacrospinous colpopexy:management of postoperative pudendal nerve entrapment. *Obstet Gynecol*. 1996;88(4 Pt 2):713–715.
25. Lantzsch T, Goepel C, Wolters M, et al. Sacrospinous ligament fixation for vaginal vault prolapse. *Arch Gynecol Obstet*. 2001;265(1):21–25.
26. Higgs PJ, Chua HL, Smith AR. Long term review of laparoscopic sacrocolpopexy. *BJOG*. 2005;112(8):1134–1138.
27. Sylvestre CL, Herry M. Robotic–assisted laparoscopic sacrocolpopexy for stage III pelvic organ prolapse. *Int Urogynecol J*. 2013;24(5):731–733.
28. Barber MD, Visco AG, Weidner AC, et al. Bilateral uterosacral ligament vaginal vault suspension with site–specific endo pelvic fascia defect repair for treatment of pelvic organ prolapse. *Am J Obstet Gynecol*. 2000;183(6):1402–1410.
29. Shull BL, Bachofen C, Coates KW, 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):1365–1373.
30. Webb MJ, Aronson MP, Ferguson LK, et al. Post hysterectomy vaginal vault prolapse:primary repair in 693 patients. *Obstet Gynecol*. 1998;92(2):281–285.
31. Aronson MP, Aronson PK, Howard AE, et al. Low risk of ureteral obstruction with "deep" (dorsal/posterior) uterosacral ligament suture placement for transvaginal apical suspension. *Am J Obstet Gynecol*. 2005;192(5):1530–1536.
32. Carter JE, Winter M, Mendehlsohn S, et al. Vaginal vault suspension and enterocele repair by Richardson–Saye laparoscopic technique:description of training technique and results. *JSLS*. 2001;5(1):29–36.
33. Feiner B, Jelovsek JE, Maher C. Efficacy and safety of transvaginal mesh kits in the treatment of prolapse of the vaginal apex:a systematic review. *BJOG*. 2009;116(1):15–24.
34. Maher CF, Feiner B, DeCuyper EM, et al. Laparoscopic sacral colpopexy versus total vaginal mesh for vaginal vault prolapse:a randomized trial. *Am J Obstet Gynecol*. 2011;204(4):360.e1–360.e7.
35. Halaska M, Maxova K, Sottner O, et al. A multicenter, randomized, prospective, controlled study comparing sacrospinous fixation and transvaginal mesh in the treatment of post hysterectomy vaginal vault prolapse. *Am J Obstet Gynecol*. 2012;207(4):301.e1–301.e7.

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DOI: 10.15406/ogij.2016.05.00150

36. Fattah MA, Ramsay I. Retrospective multicentre study of the new minimally invasive mesh repair devices for pelvic organ prolapse. *BJOG*. 2008;115(1):22–30.

37. Concerns about Surgical Mesh for POP. U.S. Food and Drug Administration, USA; 2015.

38. Reclassification of surgical mesh for transvaginal pelvic organ prolapse repair and surgical instrumentation for urogynecologic surgical mesh procedures; designation of special controls for urogynecologic surgical mesh instrumentation. Department of Health and Human Services, Food and Drug Administration, Federal Register. 2014;79(84):24634–24635.

39. A summary of the evidence on the benefits and risks of vaginal mesh implants. Medicines and Healthcare Products Regulatory Agency, London, England; 2014:1–92.

40. Better guidance and support for NHS surgeons on vaginal tape and mesh implants. Department of Health, UK; 2012.

41. Gerald MPF, Richter HE, Siddique S, et al. Colpocleisis:a review. *Int Urogynecol J Pelvic Floor Dysfunct*. 2006;17(3):261–271.

42. Wall LL. A technique for modified McCall culdoplasty at the time of abdominal hysterectomy. *J Am Coll Surg*. 1994;178(5):507–509.

43. Gimbel H. Total or subtotal hysterectomy for benign uterine diseases? A meta analysis. *Acta Obstet Gynecol Scand*. 2007;86(2):133–144.

44. Ostrzenski A. A new, simplified posterior culdoplasty and vaginal vault suspension during abdominal hysterectomy. *Int J Gynaecol Obstet*. 1995;49(1):25–34.

45. Chene G, Tardieu AS, Savary D, et al. Anatomical and functional results of McCall culdoplasty in the prevention of enteroceles and vaginal vault prolapse after vaginal hysterectomy. *Int Urogynecol J Pelvic Floor Dysfunct*. 2008;19(7):1007–1011.

46. Cruikshank SH. Preventing post hysterectomy vaginal vault prolapse and enterocele during vaginal hysterectomy. *Am J Obstet Gynecol*. 1987;156(6):1433–1440.

47. Rahn DD, Stone RJ, Vu AK, et al. Abdominal hysterectomy with or without angle stitch:correlation with subsequent vaginal vault prolapse. *Am J Obstet Gynecol*. 2008;199(6):669.e1–669.e4.

48. Vector Forces. Rope book. 2014.

49. Karram M, Goldwasser S, Kleeman S, et al. High uterosacral vaginal vault suspension with fascial reconstruction for vaginal repair of enterocele and vaginal vault prolapse. *Am J Obstet Gynecol*. 2001;185(6):1339–1343.

50. Martins P, Filho ALS, Fonseca AM, et al. Strength of round and uterosacral ligaments:a biomechanical study. *Arch Gynecol Obstet*. 2013;287(2):313–318.

51. Luo J, Smith TM, Miller JAA, et al. In Vivo Properties of Uterine Suspensory Tissue in Pelvic Organ Prolapse. *J Biomech Eng*. 2014;136(2):021016.

Citation: Paul S. Bilateral round ligament suspension (RLS) of the vaginal vault during total abdominal hysterectomy (TAH) or total laparoscopic hysterectomy (TLH) to prevent post hysterectomy vault prolapse (PHVP) – an innovative surgical technique. *Obstet Gynecol Int J.* 2015;5(2):295–298.
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