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

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 2 cm 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 surgery or if the supports are not strong enough. The risk factors for PHVP include 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 Cesareans, 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 be 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).

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°C 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±0.7 MPa (ranging from 1.2 to 11.5 MPa). The stiffness of the uterosacral ligaments was 14.1±1.4 MPa (ranging from 5.7 to 26.1 MPa) with maximum stress of 6.3±0.8 MPa (ranging from 2.2 to 11.9 MPa). There was a strong positive correlation between stiffness and maximum stress in female pelvic ligaments (p=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±1.8 MPa; p=0.033) and maximum stress (8.2±0.9 vs. 4.2±1.1 MPa; 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).
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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.

Conclusion

Round ligament suspension of the vaginal vault during abdominal hysterectomy might be a simple and useful procedure to prevent subsequent vault prolapse. It could be used as a separate procedure or as an adjunct to uterosacral and cardinal ligaments suspensions.

References


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