



A Review of Risk Factors of Vaginal Cuff Dehiscence After Different Routes of Hysterectomy

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Abstract

Background: Vaginal cuff dehiscence is a rare complication of hysterectomy, but it can lead to serious sequela like peritonitis, sepsis, bowel evisceration, and bowel necrosis.

Methods: We conducted a systematic search on Medline on July 11, 2023 to retrieve published data of risk factors for vaginal cuff dehiscence after hysterectomy with different routes for vaginal cuff closure. Inclusion criteria were English language, presence of terms “vaginal cuff” or “vaginal cuff dehiscence” combined with terms indicating surgical procedures (e.g., hysterectomy routes and suture protocols) or previously reported risk factors. We excluded case reports and literature reviews. Literature reviews were used to cross-reference but were not included. Abstracts were screened then full texts were reviewed to determine if studies met inclusion criteria.

Results: The keyword phrase “vaginal cuff dehiscence” (no MeSH term was found), yielding 162 results. Of the initial 162 articles, 47 articles met the initial screening criteria. After thorough review of inclusion and exclusion criteria, 17 retrospective studies, 2 case series, and 4 randomized controlled trials were identified. The possible risk factors for vaginal cuff dehiscence were laparoscopic hysterectomy with or without robotic assistance [8 articles], normal body mass index (BMI) [3 articles], smoking [4 articles], single layer closure [3 articles], and levels of physician skill [3 articles].

Keywords: Hysterectomy, Laparoscopic Hysterectomy, Robotic Assisted Total Laparoscopic Hysterectomy, Surgical Complication, Total Abdominal Hysterectomy, Vaginal Cuff Closure, Vaginal Cuff Dehiscence

Introduction

Hysterectomy is one of the most common major gynecological surgeries performed in the United States (US) [1]. It is estimated that about one third of women will undergo a hysterectomy by the age of 60 [2]. The most common complications of hysterectomy can be categorized as infection, venous thromboembolism, genitourinary (GU) and gastrointestinal (GI) tract injury, hemorrhage, and nerve injury [3]. One of the uncommon complications of hysterectomy includes vaginal cuff dehiscence (VCD) [2, 4]. VCD means that the anterior and posterior edges of the vaginal cuff separate and can be partial or complete [5]. It is estimated that it occurs in about 0.14-4.1% but with total laparoscopic hysterectomy (TLH) being highest [5-10]. The possible associated risks resulted from the VCD include peritonitis, sepsis, bowel evisceration, and bowel necrosis [5-6, 11-15]. Common symptoms from VCD include abdominal

pain, vaginal bleeding, vaginal discharge, and dyspareunia [8, 16-18]. The average time to VCD was found to be 6.1 weeks to 1.6 years after hysterectomy (1), however it can occur up to 30 years after the surgery [19]. It is becoming more prevalent in recent years since the growing field of minimally invasive surgery technique [20]. Minimally invasive surgeries allow for faster recovery and shorter length of stay compared to open techniques. Robotic and laparoscopic surgeries have higher rates of VCD compared to total vaginal hysterectomy (TVH) or total abdominal hysterectomy (TAH) [1, 6, 11, 21]. However, the major risk factors of VCD need to be further investigated.

The objective of this review article was to identify the possible risk factors associated with VCD including route of hysterectomy, surgical technique, patients' characteristics, peri-operative findings and physician skills.

Materials and Methods

The researcher conducted a Medline search with the librarian at Rowan-Virtua School of Medicine Health Sciences Library in Glassboro, New Jersey on July 11, 2023, using the keyword phrase “vaginal cuff dehiscence” (no MeSH term was found), yielding 162 results. The data were then manually screened titles and/or abstracts from the first search, using inclusion/exclusion criteria such as English language, presence of terms “vaginal cuff” or “vaginal cuff dehiscence” combined with terms indicating surgical procedures (e.g., hysterectomy routes and suture protocols) or previously reported risk factors from the initial literature search. Of the original 162 papers screened, 47 were identified as relevant to the requested search. Inclusion criteria were English written including risk factors for VCD. From the initial literature search, case reports and literature reviews were excluded. Literature reviews were used to cross-reference only. Abstracts were screened then full texts were reviewed to determine if studies met inclusion criteria. After thorough review of inclusion and exclusion criteria, 17 retrospective studies, 2 case series, and 4 randomized controlled trials were included for the current study.

Results and Discussion

There was a total of 23 articles available identified in this literature search which evaluated the following risk factors: route of hysterectomy, surgical technique, patients' characteristics, peri-operative findings and physician skills. A total of 6 articles found TLH increased risk for VCD, 1 article that robotic assisted total laparoscopic hysterectomy (RATLH) increased risk, 1 article stated that RATLH or TLH increased the risk, 1 article showed laparoscopic assisted vaginal hysterectomy (LAVH) increased the risk, 1 article found that multiport access TLH (MPA-TLH) increased risk, and 1 article concluded there is no difference according to route of hysterectomy [6, 8, 11-12, 15, 21, 23-25, 30, 36].

When comparing surgical technique, the following were included: single versus double layer closure, type of colpotomy, continuous versus interrupted suture, type of suture, and method of colpotomy. When comparing single versus double layer closure, 3 articles found that double layer closure was protective and 2 article found no difference [27-31]. 3 articles concluded that the type of colpotomy (cold knife versus monopolar or bipolar)

does not contribute to VCD risk, one article found that creating colpotomy with a cold knife increases risk, and another article found that ultrasonic wavelengths increase risk [8, 11-12, 22, 35]. When comparing continuous versus interrupted, one article found no difference 1 article concluded that continuous decreases risk 1 article found that interrupted increases risk [31,12,8]. 4 articles found that barbed suture decreases risk and 3 articles concluded that suture does not matter [12, 15, 22, 26, 32-34]. 1 article found that absorbable suture increases the risk of VCD [32]. 1 article that showed vaginal closure of the colpotomy increases risk [24].

When comparing closure, laparoscopic, using a device, and hand sewn, 1 article found that it did not matter [12]. The following patient' characteristics were included: BMI, smoking, menopausal status, parity, race, and prior surgery. 3 articles concluded that most VCD occur in patients with a normal BMI, 1 did not associate a difference with BMI and 2 showed that a higher BMI may be protective [11-12, 15, 21-22, 26]. 4 articles showed that smoking increases the risk of VCD and 1 article found that all VCD occurred in non-smokers [11, 21, 26, 29]. Two articles found that premenopausal status increases risk of VCD and another article concluded that age is a protective risk factor [11, 21-22]. 1 article showed that parity of 2 or more, white race, history or laparotomy or prior surgery increases risk of VCD [11].

Peri-operative findings included indication for hysterectomy. 1 article showed that benign indication for hysterectomy showed more VCD, another found that malignant indication increased risk, whereas another article concluded that VCD was higher in patients undergoing minimally invasive surgery for benign indication but higher in patients undergoing TAH for malignant indication [11, 15, 22, 30, 36]. 2 articles showed no difference between benign and malignant indication [6, 22]. When evaluating surgeon experience, one article found that VCD is associated with a high-volume physician, one article found that it is associated with <5 years of experience and another that it is associated with level 1 surgeons according to European Society for Gynecologic Endoscopy (ESGE) [8, 26, 38]. Level one surgeon refers to the Bachelor in Gynecological surgery, second level refers to the Minimal Invasive Gynecological Surgeon and third level refers to the master in hysteroscopy and the laparoscopic pelvic

Table 1: Literature Review Including Author, Article Type, Compared Groups and Findings

All 23 articles included in this review can be found in this table. Article type (retrospective, observational or randomized control study), subject numbers, variables compared, and findings are included in this table.

Article number	Authors, published year	Article type	Subject numbers	Variables compared	Findings
6	[6]	Retrospective study	8,335 patients	Route of hysterectomy	In this study, 34 patients (0.39%) underwent VCD. TLH was associated with greater risk ($p < 0.05$).
				Type of closure	There was no difference in the type of closure (closure versus no closure) ($p > 0.05$).
				Indication for hysterectomy	There was no difference in the indication for hysterectomy (benign versus prolapse versus malignant) ($p > 0.05$).
8	[8]	Retrospective observational study	13,645 patients	Routes of hysterectomy	There were 22 VCD in this study. Of those 22, 15/22 VCD occurred after TLH (incidence of 1.27%) compared to TAH with the lowest rate (0.02%) ($p < 0.001$).
				Continuous vs interrupted vs figure of eight suturing	In 13 out of 15 cases, interrupted stitches were used.
				Method of colpotomy	In the VCD group that underwent a TLH, 11/15 used sonic beat (ultrasonic energy compared with cold knife, monopolar coagulation of thunderbeat (bipolar and ultrasonic energy).
				Physician skill	In 11 out of 15 cases of VCD, the surgeons had <5 years of operative

					experience.
11	[11]	Retrospective observational study	7,039 patients	Route of hysterectomy	In women undergoing hysterectomy, found an incidence of VCD was 0.39% (28/7039). After TLH, the incidence was 0.75% compared with LAVH (0.46%), TAH (0.38%) and TVH (0.11%) (CI .21-.56).
				Patient characteristics	In those 28 patients, the average age was 42.5 and BMI was 24.9. The majority were white (82.1%), parity of 2 or more (67.9%), premenopausal (67.9%), and did not smoke (60.7%).
				Indication for hysterectomy	Most patients with a VCD had a benign indication for hysterectomy (82.1%).
				Type of colpotomy	In the patients with a VCD, colpotomy was made with cold knife in 50% or monopolar in 46.4%.
12	[12]	Retrospective study	2,382 patients	Route of hysterectomy	23 patients were diagnosed with a VCD (0.96%). TLH and robotic were associated with increased odds of VCD (odds ratio of 23.4 and 73 respectively) (p=0.00 and p=0.0006 respectively) .

				Patient characteristics	Age, race, BMI, or any comorbidity was not statistically significant between the two groups ($p>.05$).
				Indication for surgery	Indication for surgery was not statistically significant between the two groups ($p>0.05$).
				Type of colpotomy	Type of colpotomy (cold, bipolar, monopolar, harmonic scalpel) was not statistically significant ($p>0.05$).
				Mode of closure	Mode of closure (hand sewn vs laparoscopic suture with intracorporeal knotting vs laparoscopic suturing with extracorporeal knotting vs suturing assisted by device vs missing) was not statistically significant ($p=0.29$).
				Type of suture	Suture material (multifilament absorbable, monofilament absorbable, barbed, permanent suture, or missing) was not statistically significant ($p=0.58$).
				Continuous vs interrupted vs figure of eight suturing	When comparing continuous suturing versus interrupted, Continuous suturing was a protective factor (OR .24, $p=0.03$).

15	[15]	Retrospective study	1,876 patients	Continuous vs interrupted vs figure of eight suturing	In this study, 14 cases (.75%) had a VCD. Out of the 14 cases of VCD, 88% used running vicryl (0 or 2-0) suture versus barbed suture and in the non-VCD group, barbed suture or running vicryl was used (p=0.34).
				Type of suture	
				Route of hysterectomy	Route of hysterectomy was not significant (p>.05). 13/14 were status post RATLH and 1/14 was status post TLH.
				Indication for surgery	Nine out of 14 cases of VCD were for a benign indication (64.3%) versus for endometrial cancer (28.6%) or ovarian cancer (7.1%).
				Patient characteristics	Most patients with a VCD had a normal BMI (22.48) and were 52 years old.
21	[21]	Observational case series	7,286 patients	Route of hysterectomy	In this study, 10 had a VCD. There was an incidence of 4.93% after TLH, 0.29% after TVH (TLH vs TVH 95% CI 2.6-166.9), and 0.12% after TAH (TLH vs TAH 95% CI 6.7-423.4).
				Patient characteristics	Out of the 10 patients with VCD, 90% were premenopausal, 80% had a healthy BMI, 50% were a smoker
				Indication for surgery	Out of the 10 patients with VCD, malignancy as the indication for surgery was 10%.

22	[22]	Retrospective case control study	186 patients (31 with a VCD matched to n=155 without)	Patients' characteristics	Obesity (BMI \geq 30) was found to be a protective factor (70% less likely for VCD compared to BMI <25 (p=0.03) and increasing age was also a protective risk factor in patients undergoing RATLH and TLH (p=0.02). Age, parity, race, tobacco, menopausal status, uterine weight and diabetes, were not statistically significant (p>0.05).
				Indication for hysterectomy	Indication for hysterectomy (benign or malignant pathology) was not statistically significant (p>0.05).
				Method of colpotomy	Method of colpotomy (using monopolar or not) was not statistically significant (1.33 OR using 95% CI (0.33-5.30), p=0.69).
				Type of Suture	Suture (polysorb, PDS, or barbed) used was not statistically significant (OR using 95% CI: 2.53 (0.58-11.09, p=0.22, .86 (0.13-5.53), p=0.88, .47 (0.04-5.68), p=0.56) respectively.
23	[23]	Retrospective study	9,973 patients	Routes of hysterectomy	TAH-MPA, MPA-TLH and SPA-TLH were compared. There were 9 cases of VCD in MPA-TLH group, 4 in TAH group and 0 in SPA-TLH (p<.05)

				Routes of hysterectomy	The authors analyzed six type of hysterectomy: RATLH, RRHND, TLH, laparoscopy assisted vaginal hysterectomy (LAVH), laparoscopic radical hysterectomy and node dissection, and abdominal radical hysterectomy. Patients undergoing of TLH had the highest VCD incidence (15/21).
24	[24]	Retrospective study	604 patients	Route of colpotomy	Out of the 15 VCD status post TLH, 11/15 patients had vaginal continuous locking suture versus intracorporeal continuous suture (p=0.02).
25	[25]	Observational retrospective cohort	4,059 patients	Route of hysterectomy	In patients undergoing a hysterectomy at a tertiary care center, 15 VCDs occurred (0.37%). After RALTH, VCD was highest (0.66%) followed by TLH (0.32%), TAH (0.27%), and then LAVH (0%) or TVH (0%).
26	[26]	Retrospective study	1,278 patients	Route of closure	There were 26 cases of VCD in patients undergoing RATLH or TLH were identified. Then the authors performed a case control of 208 women 182 controls and 26 cases. In 2016, there were 9 cases of VCD. In 8/9 cases of VCD, the cuff was closed laparoscopically versus vaginally.

				Type of suture	Six/nine were closed with non barbed versus barbed suture.
				Physician skill	Out of the 9 VCD cases, one surgeon had a low volume, one surgeon with moderate volume and the 7/9 with high volume.
				Patient characteristics	BMI and age also might have a protective effect (p=0.004 and p=0.02 respectively). Smoking status increased risk (p=0.10) and history of a prior laparotomy (p=0.10) or any prior surgery (p=0.13).
27	[27]	Retrospective study	202 patients	Single vs double layer closure	In patients undergoing TLH comparing single layer (each bite contained pubocervical fascia and vaginal mucosa anteriorly and vaginal mucosa and rectovaginal fascia posteriorly) or double-layer (continuous suturing in which only vaginal mucosa was included in first layer than then the pubocervical and rectovaginal fascia in the second layer) and found no difference (p>0.05) (29).

28	[28]	Retrospective cohort	2,973 patients	Single vs double layer closure	In patients who underwent TLH and compared one-layer closure versus two-layer closure. The patients with two-layer closure did not undergo dehiscence (0 vs 1%) (P<0.01).
29	[29]	Randomized control study	463 patients	Single vs double layer closure	In patients undergoing RATLH, single continuous 0-Maxon suture versus a single continuous 0-Maxon suture plus three additional imbricating figure-of-x sutures (suturing a second layer over top of the first, creating an “x”) using 0-Polysorb were compared, over the first layer and found that the group with the figure-of-x suture had a statistically significant decrease in VCD (¼ or 25%) (p<0.001).
				Patient characteristics	All of the patients that underwent a dehiscence were smokers (4/263, p<0.05)

30	[30]	Retrospective study	610 patients	Route of hysterectomy for Indication for hysterectomy	In patients undergoing a TLH for benign indication (fibroid, endometriosis, bleeding, pain or other) and 147 patients that underwent LAVH for malignancy (endometrial, ovarian cancer or other). There were more VCD in the LAVH group (17/147 or 4%, p=0.02).
				Single vs double layer closure	However, a 4-layer closure using 2-cm bites in patients undergoing LAVH was compared to a 1-layer closure in 7.5-mm bites in patients undergoing TLH. There were more VCD in the ladder suggesting a multilayer closure could be protective (p=0.02).
31	[31]	Randomized control study	195 patients	Continuous vs interrupted vs figure of eight suturing	In patients undergoing TLH were randomized to a figure of eight vault suturing and continuous running double layered suturing and concluded that neither technique had any effect on the complication rate (p>0.05). Only one VCD occurred.

32	[32]	Retrospective cohort	1,455 patients	Type of suture	Vaginal cuff was closed using absorbable vicryl (n=881) or nonabsorbable ethibond (n=574). VCD occurred in .52% in the nonabsorbable group compared with 1.4% in the absorbable group (p=.183)
33	[33]	Randomized control study	100 patients	Type of suture	Barbed suture (n=50) and vicryl (n=50) were compared in patients undergoing TLH and found that neither group reported vaginal cuff dehiscence although the use of barbed suture decreased suturing time and surgical difficulty.

34	[34]	Retrospective cohort	387 patients	Type of suture	Bidirectional barbed suture was compared with other methods of closure (monocryl, vicryl and endostitch) and found that bidirectional barbed suture greatly reduced the incidence in patients undergoing TLH (0 vs 4.2%, p=0.008). Out of the ten VCD, 4/10 used Endo Stitch, 3 closed using 0-Vicryl in a running fashion, and one using 0-Vicryl in figure of eights. The study was underpowered since a small sample size was used.
35	[35]	Randomized control study	199 patients	Method of colpotomy	Monopolar coagulation or cut was compared during colpotomy in patients undergoing a TLH. There was no difference in VCD (1/100 vs 1/99 respectively) (p=0.995).
36	[36]	Retrospective study	5,530 patients	Indication for hysterectomy Route of hysterectomy	There were 53 cases of VCD. The incidence was higher for patients with benign disease in patients undergoing a minimally invasive hysterectomy but higher in malignant disease after a TAH (p=0.011).

37	[37]	Case series	4 patients	Indication for surgery	In women undergoing TLH for endometriosis, all 4 of them had a VCD.
38	[38]	Retrospective study	617 patients	Physician Skill	VCD occurred in 2.9% in patients undergoing TLH for benign disease (18/617 patients). More patients with a VCD than without were operated by level 1 surgeons (78% vs 22%) (p<0.01) according to the (Gynecologic Endoscopic Surgical Education and Assessment) of the European Academy of Gynecological Surgery and the ESGE.
				Patients' characteristics	This study also found patients with VCD was associated with a lower uterine weight (OR .99, 95% CI 0.998-0.99, p=0.02).

VCD=vaginal cuff dehiscence, TLH=total laparoscopic hysterectomy, LAVH=laparoscopic assisted vaginal hysterectomy, TAH=total abdominal hysterectomy, BMI=body mass index, TAH-MPA=TAH with multi-port access, (MPA-TLH= TLH multi-port access and SPA-TLH=single-port access TLH, RATLH= robotic assisted total laparoscopic hysterectomy, RRHND=robotic radical hysterectomy and node dissection, ESGE=European Society for Gynecologic Endoscopy.

According to our review, the possible risk factors for VCD include mode of surgery, levels of physician skill, single layer closure, smoking, and BMI. In general, laparoscopic and robotic surgery appears to increase the risk of VCD [1, 6, 11, 12, 14, 21-23, 25]. However, it is difficult to recommend a route of hysterectomy in order to minimize the risk of VCD since each type of surgery involves a combination of risk factors, which can each independently play a role. For example, laparoscopy alone could be a protective risk factor, but only if the colpotomy is created laparoscopically. It is hypothesized that suturing laparoscopically allows the incorporation of peritoneum more easily, especially posteriorly, which allows for better approximation of tissue [5,9, 24]. believe that laparoscopy helps to improve visualization and therefore excellent reapproximation of the vaginal cuff [25]. However, this increased magnification when closing laparoscopically can trick the surgeon into believing they are incorporating more tissue than they actually are [24].

VCD might increase with a less experienced physician [21]. The difference in outcomes between different modalities of gynecologic surgery could also be due to physician's surgical skills and it has been suggested that gynecologists should choose a transvaginal approach for closure until they are more comfortable with laparoscopic suturing [8,26,38]. When comparing benign versus malignant indication, the studies included in this review were mixed, although previous studies suggest malignancy increases VCD risk [37]. However, although previous studies suggest that patients might be at a higher risk, patients with malignancy are likely at a higher risk of a more complex procedure.

In addition, it is important to consider that benign gynecological indication might not be a risk factor, but rather a measure of surgeon experiences. Gynecologist Oncologists might have fewer VCD, and thus lower the rate of VCD for malignant indications, because of their additional extensive surgical training compared with generalists performing hysterectomies for benign indications.

Specific surgical techniques are more difficult to recommend because of the number of variables involved. Most studies suggest that a double layer closure (or single with an imbricating layer) has a lower VCD rate than single layer closure perhaps because of the additional layer of reinforcement or protection if one of the sutures breaks [28, 29, 30]. Barbed suture (versus Monocryl, vicryl or endostitch) might be beneficial since the suture is self-retaining without requiring any knots, which also minimizes the technical aspect required to tie knots intracorporeally. This was found in 4 studies, although not consistent [12, 15, 22, 26, 32-34]. The type of stitch used (continuous vs figure of eight) is inconclusive in the reported studies included in this review [8, 12, 31]. Most of the included studies found that creating the colpotomy with cold knife versus energy is not significant but one article found sonic beats increases risk and another found cold knife increases risk [12, 22, 35,8,11]. Therefore, the type of suture, suturing technique and the method of creating the colpotomy requires further studies to determine risk.

Educating patients regarding activities that could lead to dehiscence including coitus and Valsalva-maneuvers is critical in the post-operative period and discouraging these activities as much as possible can help to decrease risk (3, 6). In this review, 4 studies showed that smoking increased risk for VCD [11, 21, 26, 29]. Risk factors known to contribute to infection including tobacco cessation and control of diabetes mellitus should be managed pre-operatively [14]. Normal BMI was also associated with increased risk, although this was not consistent across all reported studies. One study found BMI was not associated and two articles found increased BMI was protective [11-12, 15, 21, 22]. Increased BMI and therefore increased adipose tissue might suggest that increased levels of estrogen could play a protective role in reducing VCD risk.

There are other risk factors that were described in only 1 or 2 studies including: parity of 2 or more, white race, history of laparotomy or prior surgery, the use of absorbable suture, and laparoscopic closure. The authors cannot comment on these risk factors as so few studies were included.

Fortunately, this complication is an uncommon occurrence, but makes it more difficult to compare techniques and approaches in order to determine risk factors. Most of the current published literatures are observational studies and have limitations to investigate all possible clinical characteristics. As described in this review, there are several different surgical techniques to create and close the colpotomy, which each individually have the potential to increase risk for VCD. Combining these techniques with the different route of hysterectomy, surgeon experience, and patient demographics makes it difficult to create direct comparison groups since there are many other variables that can be involved with a VCD.

Conclusion

Common risk factors identified in this review include mode of surgery, levels of physician skill, single layer closure, smoking, and BMI. As this review and previous articles have suggested, the consensus regarding many of the risks of VCD evaluated in this review require further randomized control studies.

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Conflicts of Interest

The authors declare no conflicts of interest.

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