

# Colpotomy in da vinci single-site hysterectomy: a case report and literature review

## Abstract

**Background:** Vaginal cuff dehiscence (VCD) occurs after total hysterectomy with colpotomy when the surgical closure fails. Vaginal cuff dehiscence is defined as any separation of the edges of the cuff and vaginal evisceration is defined as the prolapse of intraperitoneal contents typically the small bowel. The rate of all vaginal cuff dehiscence (VCD) has been reported from 0.1% to 4.6% and with robotic assisted laparoscopy hysterectomies (RA-LH) as high as 7.5%. True estimated rates, however, of vaginal dehiscence are difficult to determine as most of the literature consists of case reports which have an inherent reporting bias. Vaginal dehiscence is rare compared to other surgical complications but due to its devastating nature warrants discussion.

**Objective:** The objective of this review was to compare a number of variables possibly associated with the VCD after total hysterectomy (TH). Variables compared were surgical hysterectomy approach (open, laparoscopic, vaginal and robotic), type of suture used to close the vaginal cuff (barbed or traditional), approach to colpotomy (open, laparoscopic, vaginal and robotic) and type of uterine manipulator used.

**Case:** A 50-year-old woman Gravida 0, Para 0, with a history of chronic pelvic pain and pelvic pressure, menorrhagia and anemia due to abnormal uterine bleeding secondary to leiomyoma (AUB-L) unresponsive to medical management therapy and symptoms affecting her daily activities presented to our clinic and requested laparoscopic hysterectomy.

Patient underwent Da Vinci SILS TLH (robot-assisted total hysterectomy) with bilateral salpingectomy. Hysterectomy was modified by performing colpotomy prior to uterine artery cauterization and cardinal ligament transection.

Patient had uncomplicated hospital and recovery course and was discharged on postoperative day 1. Upon return to clinic on postoperative week 3 for postoperative followup, patient did not have any complaint and reported resolutions of symptoms.

**Conclusion:** The largest amount of evidence remains that the rate of VCD is associated with robotic and laparoscopic closure of colpotomy. Some authors have made local policy changes to improve care by only closing colpotomy vaginally and have met with success. Other institutions have begun using lower power during electrocautery in order to reduce tissue damage. Barbed sutures showing improved operative times and being well tolerated have been studied in the hopes of reducing VCD with one large study showing statistically significant results.

**Keywords:** barbed suture, closure technique, colpotomy, colpotomizer, cuff dehiscence, electrothermal injury, endoscopic suturing, hysterectomy, laparoscopic hysterectomy, minimally invasive hysterectomy, robotic surgery, thermal damage, thermal injury, total laparoscopic hysterectomy, transvaginal suturing, uterine manipulator, TLH, vaginal cuff dehiscence, vaginal cuff thermal injury, vault dehiscence, VCD

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## Background

Vaginal cuff dehiscence (VCD) occurs after total hysterectomy with colpotomy when the surgical closure fails. Vaginal cuff dehiscence is defined as any separation of the edges of the cuff and vaginal evisceration is defined as the prolapse of intraperitoneal contents typically the small bowel.<sup>1</sup> The rate of all VCD has been reported from 0.1% to 4.6% and with robotic assisted laparoscopy hysterectomies (RA-LH) as high as 7.5%.<sup>2-5</sup> True estimated rates, however, of VCD are difficult to determine as most of the literature consists of case reports which have an inherent reporting bias.<sup>4</sup> Vaginal

dehiscence is rare compared to other surgical complications but due to its devastating nature warrants discussion.<sup>6</sup>

Patients with VCD typically present with pelvic pain, pelvic mass and watery or bloody vaginal discharge.<sup>7</sup> VCD is considered a surgical emergency and can occur anytime post operatively, most commonly occurring within approximately 7-13 weeks<sup>8</sup> of surgery but cases have been reported after 1 year and up to 10 years post operatively.<sup>8</sup>

Risk factors unrelated to the surgical procedures include the risks associated with poor wound healing, multiple vaginal surgeries, vaginal atrophy and most commonly early postoperative coitus.<sup>4,7,9-12</sup>

When the indication for total hysterectomy (TH) includes malignancy the risk for VCD increases 3 fold.<sup>3,10</sup> Surgical risk factors include hysterectomy approach, type of suture used to close the vaginal cuff and approach to colpotomy. Currently there is no standard for method of closure for colpotomy after TH.

## Objective

The objective of this review was to compare a number of variables possibly associated with VCD after TH. Variables compared were surgical hysterectomy approach (open, laparoscopic, vaginal and robotic), type of suture used to close the vaginal cuff (barbed or traditional), approach to colpotomy (open, laparoscopic, vaginal and robotic) and type of uterine manipulator used.

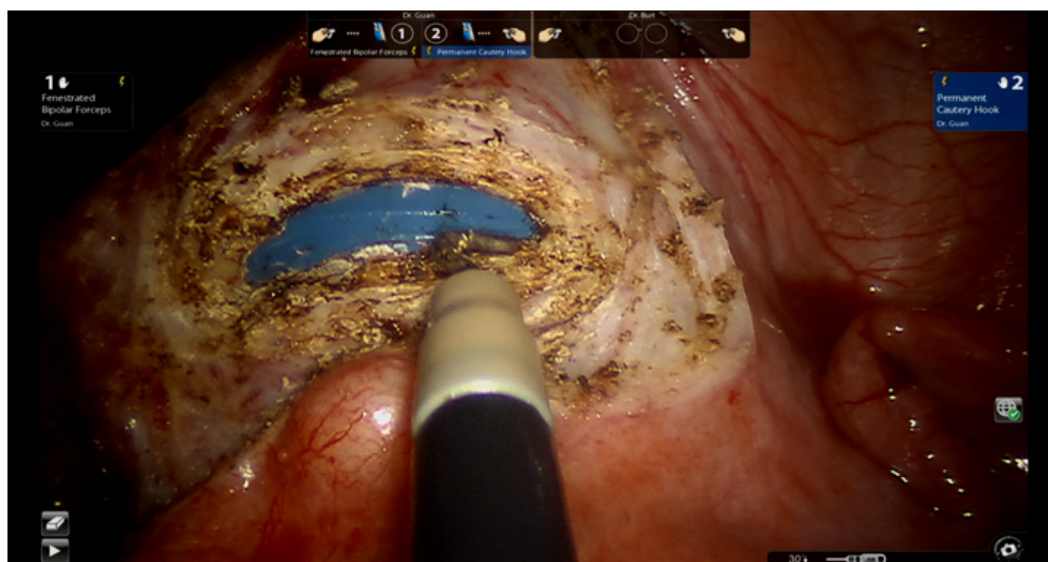
## Case

A 50-year-old woman Gravida 0, Para 0, with a history of chronic pelvic pain, pelvic pressure, menorrhagia and anemia due to abnormal

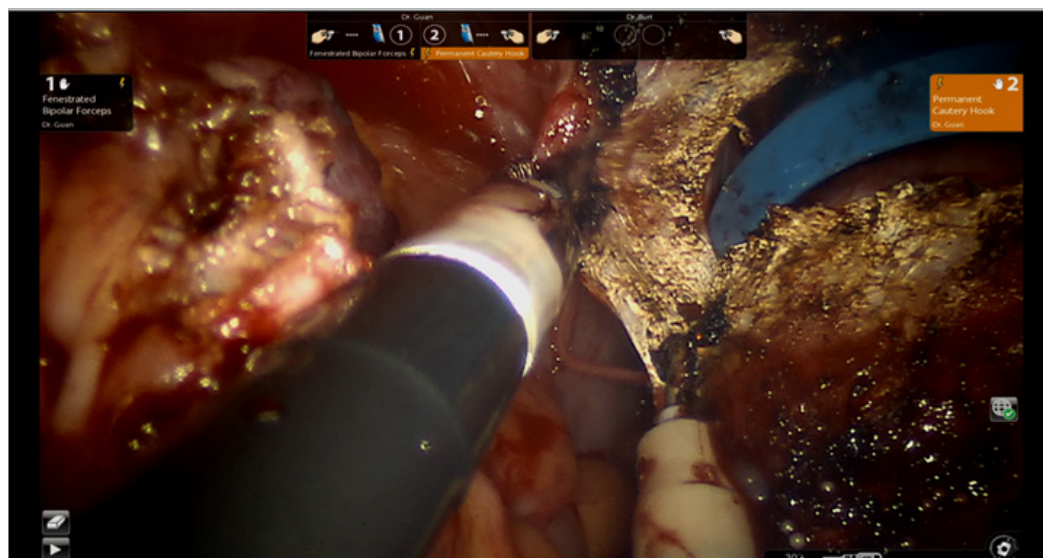
uterine bleeding secondary to leiomyoma (AUB-L). Menses typically lasted for 2 weeks. She previously had uterine fibroid embolization (UFE) without much relief of symptoms. Her symptoms were affecting her daily living activities and were unresponsive to medical management. She presented to our clinic and requested laparoscopic hysterectomy.<sup>13</sup>

MRI of the pelvis showed an enlarged bulky leiomyomatous uterus 10.3×6.7×8.8cm in size with multiple fibroids including; subserosal fibroid -4.5cm×3.2cm, intracavitary/submucosal -4cm; Fundal intramural fibroid -5.2cm and an exophytic subserosal fibroid at the posterior uterine body -4.9×5.2×3.4cm

The patient underwent Da Vinci single incision laparoscopic hysterectomy (robotic-assisted total hysterectomy) with bilateral salpingectomy. The hysterectomy was modified by performing colpotomy prior to uterine artery cauterization and cardinal ligament transection (Figure 1) (Figure 2).



**Figure 1** Intraoperative picture showing colpotomy done prior to uterine artery ligation.



**Figure 2** Intraoperative picture showing colpotomy done prior to uterine artery ligation.

The patient had an uncomplicated hospital course and was discharged on postoperative day 1. Upon return to clinic on 3 weeks after surgery for postoperative follow up, the patient did not have any complaint and reported resolutions of symptoms.

## Discussion

Some studies have shown that the majority of VCD occur within surgeons first 25 cases.<sup>14</sup> We found that by performing the colpotomy before uterine artery cauterization and cardinal ligament transection helped build up junior surgeon's confidence and reduce surgical complications.<sup>13</sup>

### Comparison of type of dissection used (sharp versus thermal)

Dissection during TH may be performed with or without the use of thermal energy. It has been proposed that tissue damage during electrocautery dissection of the colpotomy may contribute to poor wound healing and decrease tissue integrity.<sup>15</sup> Hur et al.,<sup>16</sup> found the incidence of VCD laparoscopic hysterectomies (using thermal dissection) to be higher than vaginal hysterectomies (using sharp dissection) and postulated this was due to thermal damage.<sup>16</sup> Supporting this hypothesis are animal models showing impaired wound healing when comparing sharp dissection to electrocautery<sup>17,18</sup> and histological examination of human tissue after electrocautery showed signs of chronic inflammation which could indicate delayed wound healing.<sup>19</sup> Subsequently the energy settings of electrocautery have been examined and the rate of vaginal cuff complications were generally lower with 'cut' rather than 'coag' settings.<sup>20,17</sup> In order to reduce energy damage some have suggested suturing for hemostasis rather than using electrocautery.<sup>11</sup> Rotithor and Hur have suggested methods for no energy dissection during endoscopic surgery in order to reduce the incidence of VCD, but to date no definitive results have been reported.<sup>16,21</sup>

Studies have been published with conflicting results regarding the effect of thermal injury on the rate of VCD.<sup>3,22,23</sup> Comparative reports where both arms used electrocautery but different approaches, remained to show a difference indicating energy effects were less likely to be a factor in the rate of VCD.<sup>5,23</sup> Additionally, Weizman et al.<sup>3</sup> found neither the source or the level of energy effected the rate of VCD.<sup>3</sup> No conclusive study has yet to be performed and some authors believe thermal energy is not a significant factor in the rate of VCD.<sup>3,23,24</sup>

### Comparison of approach to colpotomy closure

With development of minimally invasive surgery techniques and robotic technology allowing for 'elbowed' instruments, laparoscopic suturing has become easier but remains an advanced surgical skill and takes many hours to master.<sup>25</sup> Many surgeons are choosing to perform hysterectomies with either laparoscopic or robotic techniques as they have shown superior patient outcomes especially with regards to faster surgical times, improved pain control, reduced blood loss and reduced hospital stay.<sup>26,27</sup> Robotic systems have shown to decrease overall surgical time but colpotomy closure remains the most time consuming step in hysterectomies.<sup>25</sup> Unfortunately, several studies agreed the rate of VCD is significantly higher when using robotic or laparoscopic surgery specifically when closing the colpotomy.<sup>4,23,28-30</sup> Some studies have found the increase in VCD rate is specific to robotic systems.<sup>5</sup>

As discussed above thermal energy damage has been thought to

contribute to the increased rate of VCD as it is the most common mode of dissection during endoscopic procedures. It has also been proposed that the magnification of the 3D camera when using robotic systems could lead the surgeon to place the stitch closer to the incisional boarder not incorporating enough healthy tissue contributing to VCD.<sup>2,11,31</sup> Conversely, the vaginal approach to closure allows for greater tissue purchase and superior knot tying during colpotomy closure.<sup>31</sup> No studies have been performed to date which test this hypothesis comparing measured tissue bites in robotic closure of colpotomy.

With growing evidence suggesting VCD is associated with laparoscopic and robotic closure of vaginal cuff, Ucella, proposed vaginal closure regardless of surgical approach should become the gold standard for hysterectomies but to date no coconscious has been reached.<sup>3,23,29,31</sup> Stevens and Ucella have both made this their standard and observationally report success in their institutions after converting all TH to vaginal cuff closure.<sup>29,31</sup>

### Comparison of type of uterine manipulator used (Hohl vs VCare®)

Uterine manipulators are commonly used to assist in hysterectomies. They were developed to assist in colpotomy with advent of a cup which can surround the cervix providing a surface for dissection and manipulating the uterus to prevent injury.<sup>32,33</sup> However, many models exist with different designs, and no single model has clearly shown any benefit during TH.

Some of the most commonly used uterine manipulators on the market today are the Hohl manipulator and VCare® manipulator both of which use a cervical cup. Although the benefits of different uterine manipulators may depend on surgeon preference, the rate of VCD associated with each does not significantly vary.

In a product review for VCare® manipulator, Greenberg found the main advantage during TH was it reduced surgical times and reduced the rate of injury to the ureters or bladder.<sup>34</sup> Akdemir and Cirpan discussed how although the Hohl manipulators were easy to use and decreased the rate of VCD, complications arose mainly from improper use of the manipulator.<sup>35</sup> Such complications were uterine perforation and bowel injury, they concluded that improper use of manipulator may overshadow its advantages.<sup>35</sup>

Van den Haak et al.<sup>36</sup> highlighted the use of uterine manipulators for prevention of ureter injuries during TH, however there is still lack of data regarding how this prevention occurs.<sup>36</sup> Ultimately, Van den Haak concluded use of uterine manipulators in TH is unlikely to negatively impact the outcome of TH, but was inconclusive in the direct benefit on the rate of VCD.<sup>36</sup>

### Comparison of type of suture used to close colpotomy

Laparoscopic suturing is an advanced surgical skill and is often the most time consuming portion of TH.<sup>25</sup> Barbed sutures were developed to in order to keep wound edges approximated and maintain tension during closure allowing for easier running suturing. The development of barbed sutures has improved the learning curve for endoscopic suturing<sup>27,28,37-39</sup> and sustained tension provided while suturing the approximated edges leads to greater tissue stability. Unfortunately, because the rate of VCD is very low many studies when adopting barbed sutures examined how they were tolerated by patients postoperatively and showed no increase in common postoperative complications such as infection, pain or postoperative bleeding.<sup>27,39</sup>

The most recent notable report of barbed sutures on the effect of VCD was published in 2015 by Rettenmaier et al.<sup>40</sup> in which they compared the use of barbed sutures with Vicryl sutures in endoscopic (laparoscopic and robotic surgery) hysterectomies.<sup>40</sup> With a sample size of 1876 they were able to see a statistically significant reduction in VCD.<sup>40</sup> In fact no VCD were found to occur when barbed sutures were used.<sup>40,41</sup> These findings are similar to other observational studies with much smaller sample sizes.<sup>13,39</sup>

## Conclusion

In conclusion through a thorough literature review of VCD there are obviously numerous factors which contribute to the risk

of VCD (Table 1). A major risk factor as many authors agree is the precipitating event of early coitus illustrating the importance of patient teaching and emphasizing following recommendations. Those risks which are within the power of the physician to control should be modified in order to reduce the risk of VCD. The largest amount of evidence remains that the rate of VCD is associated with robotic and laparoscopic closure of colpotomy. Some authors have made local policy changes to improve care by only closing colpotomy vaginally and have met with success. Other institutions have begun using lower power during electrocautery in order to reduce tissue damage. Barbed sutures showing improved operative times and being well tolerated have been studied in the hopes of reducing VCD with one large study showing statistically significant results.

**Table 1** Mode of Hysterectomy and percentage of vaginal cuff dehiscence (VCD)

	Author	Year	Type	# Pts	Results
1.	Kashani <sup>2</sup>	2012	Observational case series	654	0.4% VCD with RAH 0.96% VCD rate overall 0.50% VCD with TAH
2.	Weizman <sup>3</sup>	2015	Retrospective	2,382	0.32% VCD with TVH 1.05% VCD with TLH 3.15% VCD with TRH
3.	Ceccaroni <sup>7</sup>	2011	Multicentric Retrospective	8635	0.39% VCD
4.	Hur <sup>9</sup>	2011	Observational cohort study	12,472	1.35% VCD with TLH
5.	Drudi <sup>10</sup>	2013	Prospective Descriptive	441	1.6% VCD with RAH All oncology cases
6.	O'Hanlan <sup>11</sup>	2016	Retrospective Cohort Study	1924	0.26% VCD
7.	Hada <sup>12</sup>	2010	Retrospective	677	0.6% VCD with TLH 2.61% VCD with RALH
8.	Dauterive <sup>14</sup>	2012	Retrospective chart review	731	1.94% with TLH (P = 0.60)
9.	Lawlor <sup>20</sup>	2015	Retrospective	150	0.2% VCD 0% VCD with LAVH
10.	Fanning <sup>23</sup>	2013	Prospective analysis	610	4% VCD with TLH (P = 0.02) 1.7% VCD overall
11.	Nick <sup>24</sup>	2011	Retrospective study	417	1.1% VCD with TLH 3.0% VCD with TRH (P = 0.22)
12.	Kim <sup>26</sup>	2014	Retrospective	604	0.49% evisceration, 3.47% VCD with

Table Continued

	Author	Year	Type	# Pts	Results
			Retrospective Cohort Study		1.3% VCD with transvaginal interrupted sutures
13.	Blikkendaal <sup>28</sup>	2012		331	3.3% VCD with laparoscopic interrupted sutures 2.4% VCD with laparoscopic running sutures
			Multi-institutional analysis		0.64% VCD with TLH
14.	Uccella <sup>30</sup>	2012		12,398	0.21% VCD with TAH 0.13% VCD with TVH
			Retrospective study		0.6% VCD with AH
15.	Koo <sup>42</sup>	2013		9,973	0.4% VCD with TLH Not statistically significant
16.	Lopez <sup>43</sup>	2016	Retrospective Cohort Study	100	2% VCD
17.	Kho <sup>44</sup>	2009	Retrospective	510	4.1% VCD with RAH
18.	Shin <sup>45</sup>	2011	Retrospective	168	No VCD reported with TLH and LAVH
19.	Chen <sup>46</sup>	2017	Retrospective	585	0.3% VCD with RAH

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## Conflicts of interest

Other authors did not report any potential conflicts of interests.

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