

Review Article

The Use of Barbed Suture for Laparoscopic Hysterectomy and Myomectomy: A Systematic Review and Meta-analysis

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ABSTRACT We conducted a meta-analysis comparing the efficacy of laparoscopic suturing with or without barbed suture for myomectomy or hysterectomy. We used a systematic electronic search strategy of published literature using the following databases: Cochrane Database of Systematic Reviews, MEDLINE, Embase, and OVID MEDLINE In-Process & Other Non-Indexed Citations databases. The following medical subject heading terms, key words, and their combinations were used: laparoscopy, myomectomy, hysterectomy, and barbed suture. Studies in which women undergoing laparoscopic myomectomy or hysterectomy using barbed suture or conventional suture were selected. The main outcome measures chosen for the current meta-analysis were operative time, suturing time, estimated blood loss or change in hemoglobin level, and degree of suturing difficulty. The results of the meta-analysis studies were expressed as the standardized mean difference (SMD) with 95% confidence intervals (CIs). Compared with the use of conventional suture, the total operative time of laparoscopic myomectomy (SMD = -0.58 ; 95% CI, -0.88 to -0.28) and the suturing time to close the uterine incision (SMD = -1.38 ; 95% CI, -1.86 to -0.90) were significantly reduced with the use of barbed suture. Meta-analysis on laparoscopic hysterectomy shows that the time to suture the vaginal vault, the total operative time, and the estimated blood loss were comparable with or without the use of barbed suture. The degree of suturing difficulty was reported in 2 randomized trials. Compared with the use of conventional suture, the degree of suturing difficulty was lower with the use of barbed suture (SMD = -1.39 ; 95% CI, -1.83 to -0.95). The use of barbed suture facilitates laparoscopic suturing of myomectomy incision and closure of the vaginal vault. Its use is associated with a reduced operative time of laparoscopic myomectomy. Journal of Minimally Invasive Gynecology (2014) 21, 210–216 © 2014 AAGL. All rights reserved.

Keywords: Barbed Suture; Laparoscopic Hysterectomy; Laparoscopic Myomectomy; Myomectomy; Vaginal Vault; Vaginal Vault Dehiscence

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Barbed suture is a relatively new type of suture that has been widely used by plastic surgeons for cosmetic surgery. It consists of standard monofilament suture with tiny barbs cut into the length of the suture in a helical array set facing in opposite directions. Because of the presence of barbs on the suture, it approximates the tissue without the need of a

surgical knot. Approved by the Food and Drug Administration, it has been commercially available in the United States since 2007. In gynecology, it has been used since 2008 for laparoscopic myomectomy and hysterectomy [1].

Currently, there are 2 types of barbed sutures: bidirectional (Quill Self Retaining System; Angiotech Pharmaceuticals, Inc., Vancouver, British Columbia, Canada) and unidirectional sutures (V-Loc suture; Covidien, Mansfield, MA). The bidirectional suture has 2 needles, and suturing has to be started at the middle of the incision in 1 direction with 1 needle and another direction with another. The unidirectional suture consists of a surgical needle at 1 end and a loop at the other end for securing the suture (Fig. 1). After the first bite to the tissue, the suture is inserted into the

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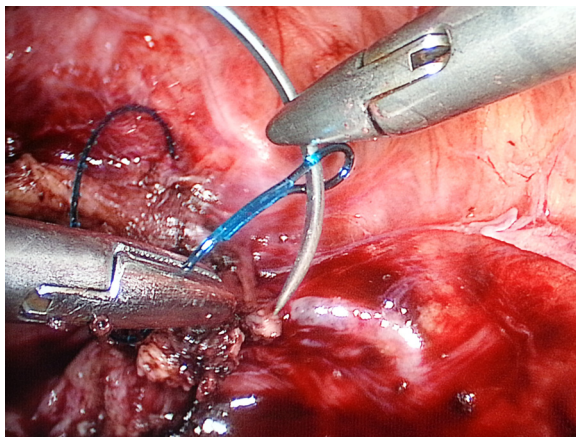
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Fig. 1

The insertion of a unidirectional barbed suture into the suture loop at the angle of vaginal vault.



loop, and suturing is continued. Without the need of knot tying, its use facilitates laparoscopic suturing.

The tensile strength of both types of barbed sutures is practically similar [2,3]. The newest type of barbed suture has barbs that change direction midway down the suture (Stratafix; Ethicon Inc, Somerville, NJ). It has yet to be evaluated clinically. To date, there is still a paucity of information about the use of barbed suture in gynecology. We conducted a meta-analysis comparing the efficacy of laparoscopic suturing with barbed suture or conventional suture for myomectomy or hysterectomy.

Materials and Methods

Search Strategy

We used a systematic electronic search strategy of published literature using the following databases: Cochrane Database of Systematic Reviews, MEDLINE, Embase, and Ovid MEDLINE In-Process & Other Non-Indexed Citations databases. The following medical subject heading terms, key words, and their combinations were used: laparoscopy, myomectomy, hysterectomy, and barbed suture. The electronic search was limited to studies in humans published in English

after 1979. We manually searched the reference lists of identified studies.

Study Selection

Studies in which women undergoing laparoscopic myomectomy or hysterectomy using barbed suture or conventional suture were selected (Tables 1 and 2). Barbed sutures could be unidirectional or bidirectional sutures. Cohort studies that did not use any comparison with conventional suture were excluded. We also excluded studies in which the myomectomy or hysterectomy was performed with robotic assistance. Although such studies were excluded from the quantitative meta-analysis, their results were included in the discussion.

Summary Measures and Quantitative Data Synthesis

The main outcome measures chosen for the current meta-analysis were operative time, suturing time, estimated blood loss or change in hemoglobin level, and degree of suturing difficulty. The degree of difficulty was measured using a range from 1 for low difficulty and 10 for high difficulty. The results of the meta-analysis studies were expressed as the standardized mean difference, which is the difference in means of 2 arms divided by the pooled standard deviation with 95% confidence intervals. Because outcomes reported from different studies might not be on the same scale and to create a comparable scale across studies, we reported the standardized mean difference instead of the mean difference.

Results

The literature search identified 101 citations of barbed suture. Of these, 9 citations were related to hysterectomy and 8 others to myomectomy. Studies that did not include a control group were excluded. Ultimately, 3 citations related to myomectomy [4–6] and another 4 citations related to hysterectomy [3,7–9] were evaluated. There were 2 randomized studies in the hysterectomy citations [7,8] and only 1 in the myomectomy citations [4]. Relevant characteristics of included trials are summarized in Tables 1 and 2.

Table 1

Comparative studies of laparoscopic myomectomy with or without barbed suture

Authors	Design	Study arm	Control arm
Alessandri et al, 2010 [4]	Single-center RCT	Unidirectional barbed suture (n = 22)	Polyglactin sutures intracorporeal knots (n = 22)
Einarsson et al, 2011 [5]	Retrospective	Bidirectional barbed suture (n = 107)	Polydioxanone sutures intracorporeal knots (n = 31)
Angioli et al, 2012 [6]	Prospective study with a historic control	Bidirectional barbed suture (n = 19)	Polyglactin sutures intracorporeal knots (n = 20)

RCT = randomized controlled trial.

Table 2

Comparative studies of total laparoscopic hysterectomy with or without barbed suture			
Authors	Design	Study arm	Control arm
Siedhoff et al, 2011 [3]	Retrospective: laparoscopic hysterectomy or trachelectomy	Bidirectional barbed suture (n = 149)	Conventional suture (n = 238)
Einarsson et al, 2013 [7]	RCT	Bidirectional barbed sutures (n = 32)	Polydioxanone sutures with LAPRA-TY (n = 31)
Ardivino et al, 2013 [8]	RCT	Bidirectional barbed suture (n = 18)	Poliglecaprone suture, extracorporeal (n = 20) or intracorporeal knots (n = 23)
Bassi and Tulandi, 2013 [9]	Retrospective	Unidirectional barbed suture (n = 63)	Polydioxanone suture intracorporeal knots (n = 139)

RCT = randomized controlled trial.

In a study of laparoscopic hysterectomy by Ardivino et al [8], there were 2 control arms (intra- or extracorporeal knot tying). There was no significant difference in the operative time, suturing time, and degree of surgical difficulty between the 2 groups. For the meta-analysis, we combined them into 1 control arm with 43 cases, and we recalculated the means and standard deviations (SDs). We imputed the SDs for blood loss based on the study of Alessandri et al [4]. We used half of the mean blood loss as an estimate of SD, applied SD for the study arm with a mean of 0.2, and estimated SD of blood loss for the study arm as 0.1. The mean and SD for the pooled control arm were calculated based on means, SDs, and sample sizes of the 2 control arms.

All 4 citations on laparoscopic myomectomy reported operative time (mean and SD for each arm). However, blood loss was reported as estimated blood loss or the difference in hemoglobin level before and after surgery (delta hemoglobin). Only 2 studies reported suturing time [5,8]. Of the 4 citations on laparoscopic hysterectomy, 3 studies reported operative time (mean \pm SD or median and range), only 2

studies reported suturing time, and 3 studies reported estimated blood loss or delta hemoglobin.

Figures 2 and 3 show forest plots of operative time and suturing time of laparoscopic myomectomy with or without barbed suture. They show that the total operative time and the suturing time to close the uterine incision were significantly reduced with the use of barbed suture.

A meta-analysis on laparoscopic hysterectomy shows that the time to suture the vaginal vault, the total operative time, and the estimated blood loss were comparable with or without the use of barbed suture (Figs. 4–6). The degree of suturing difficulty was reported in 2 randomized trials. Suturing with barbed suture was clearly easier than that with conventional sutures (Fig. 7).

Discussion

Suturing is 1 of the most challenging tasks in laparoscopy. Several authors have reported the use of barbed suture in laparoscopic myomectomy or hysterectomy [1,3–9]. One

Fig. 2

A forest plot of operative time of laparoscopic myomectomy with or without barbed suture.

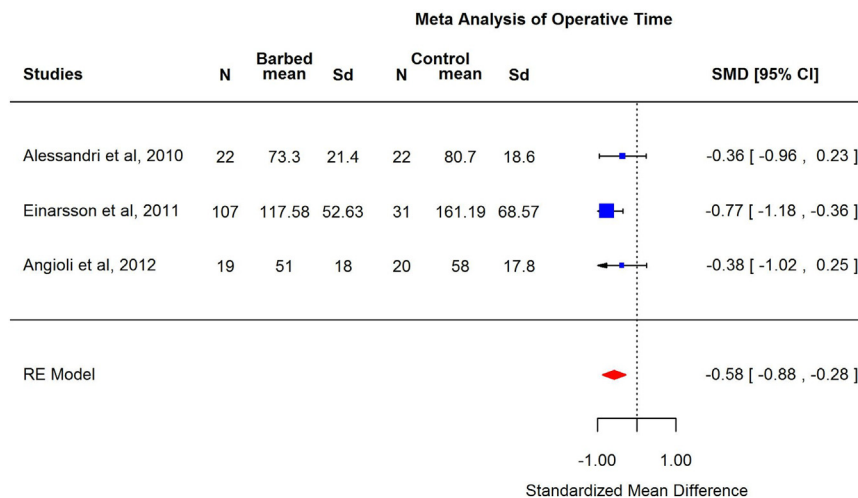
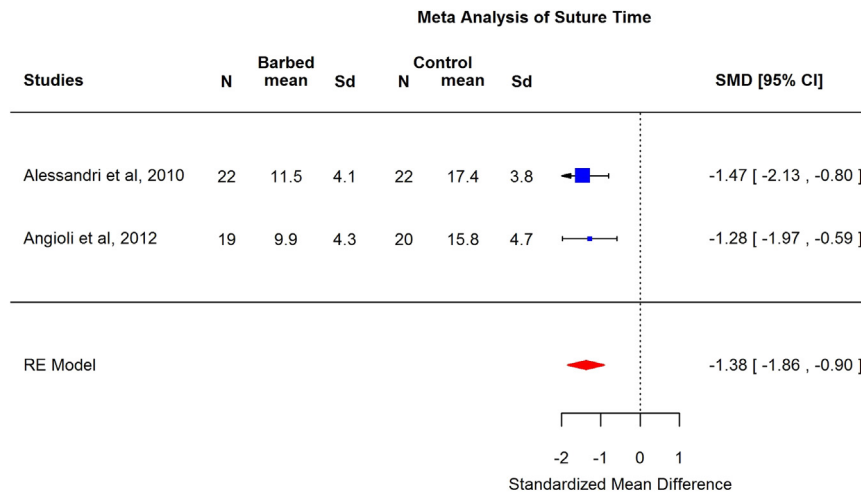


Fig. 3

A forest plot of suturing time of laparoscopic myomectomy with or without barbed suture.



of the possible advantages of barbed suture is that it maintains tension on the suture line during suturing.

To date, there has been only 1 randomized study comparing the efficacy of barbed suture or conventional suture for laparoscopic myomectomy [4]. In this small but randomized study, the uterine defect was closed either with a polyglactin suture (Vicryl; Ethicon Inc., Somerville, NJ) in 22 patients or unidirectional barbed suture in another 22 patients. The duration of surgery in both groups of patients was comparable. Yet, the time to suture the uterine incision with barbed suture was significantly lower than that with conventional suture. The difference in the hemoglobin level before and after surgery was also significantly lower in the group with barbed suture.

Supporting a previous prospective study of myomectomy by minilaparotomy [10], our meta-analysis showed that the use of barbed suture for uterine closure reduced the operating time (Fig. 2). We also found decreased suturing time with the use of barbed suture (Fig. 3). The estimated blood loss tended to be lower with the use of barbed suture (Fig. 8); however, blood loss during myomectomy could be influenced by many factors including the total number of myomas removed, the length and number of uterine incisions, the surgical plane, and the use of vasopressin or pre-operative use of gonadotropin-releasing hormone agonist.

In contrast to that of laparoscopic myomectomy, our meta-analysis showed that there was no significant difference in the total operating time, suturing time to close the

Fig. 4

A forest plot of operative time of laparoscopic total hysterectomy with or without barbed suture.

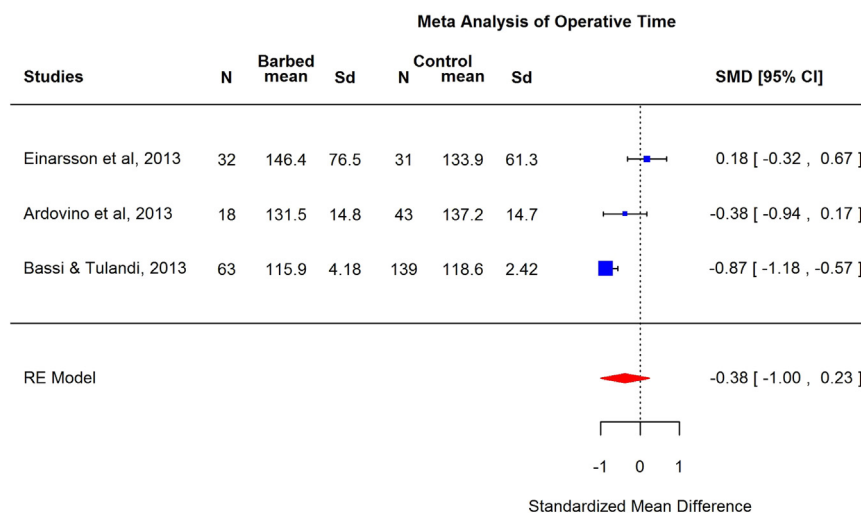
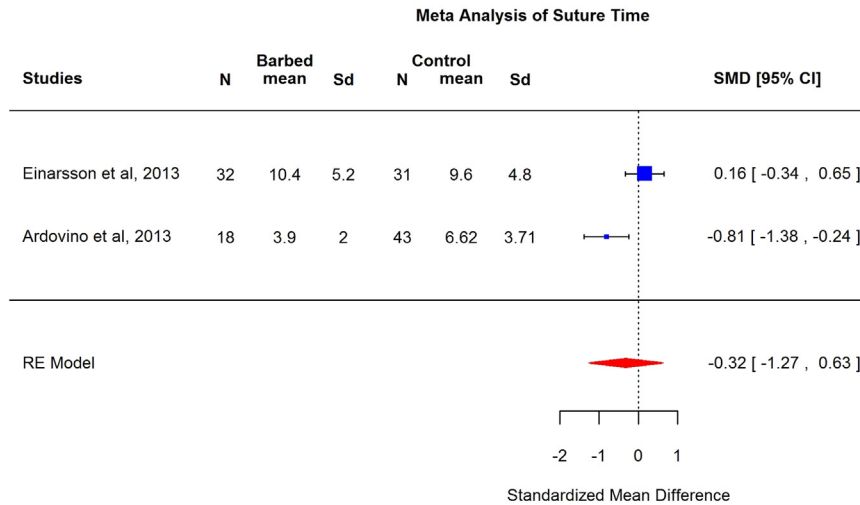


Fig. 5

A forest plot of suturing time of laparoscopic total hysterectomy with or without barbed suture.



vaginal vault, and estimated blood loss with or without the use barbed suture. Similar to that of myomectomy, many factors could influence the duration of surgery and blood loss. These include the uterine volume and the presence of endometriosis or intra-abdominal adhesions. Furthermore, the experience and the expertise of the primary surgeon could also play a role. Einarsson et al [7] reported that the duration of vaginal closure by attending staff members was significantly shorter than that by residents or fellows [7].

In a retrospective study, Siedhoff et al [3] reported that the incidence of vaginal vault dehiscence after vault closure with conventional sutures was 4.2% and none in the group with barbed suture. Whether it is merely related to the use of

barbed suture is unclear. In our cohort of 202 cases of laparoscopic total hysterectomy [9] and in another cohort of 134 cases of robotic hysterectomy [11], no vault dehiscence with or without barbed suture was encountered. Data about vault dehiscence with or without the use of barbed suture are very limited. In addition, many factors contribute to the development of dehiscence.

Because the objective of our meta-analysis was to compare the outcome of conventional laparoscopic hysterectomy with or without barbed suture, we excluded robotic-assisted hysterectomy from the meta-analysis. However, in a cohort study of 202 women who underwent robotic-assisted hysterectomy with or without barbed suture to close

Fig. 6

A forest plot of estimated blood loss of laparoscopic total hysterectomy with or without barbed suture.

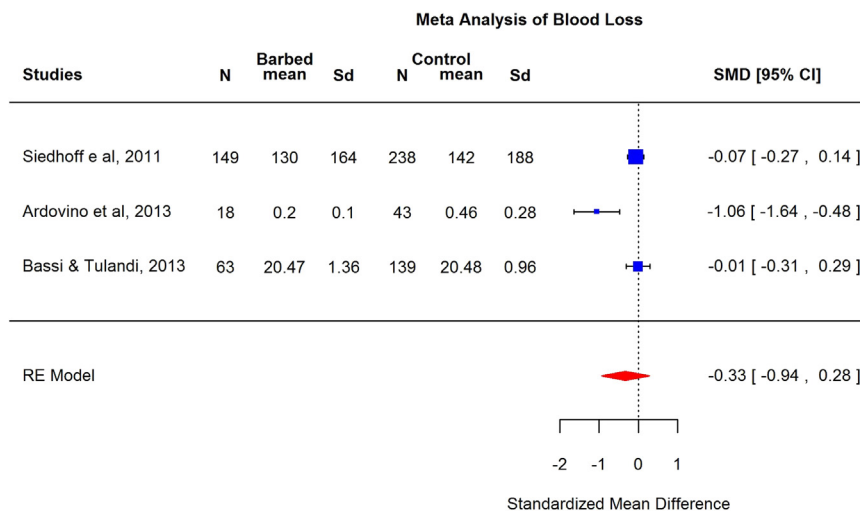
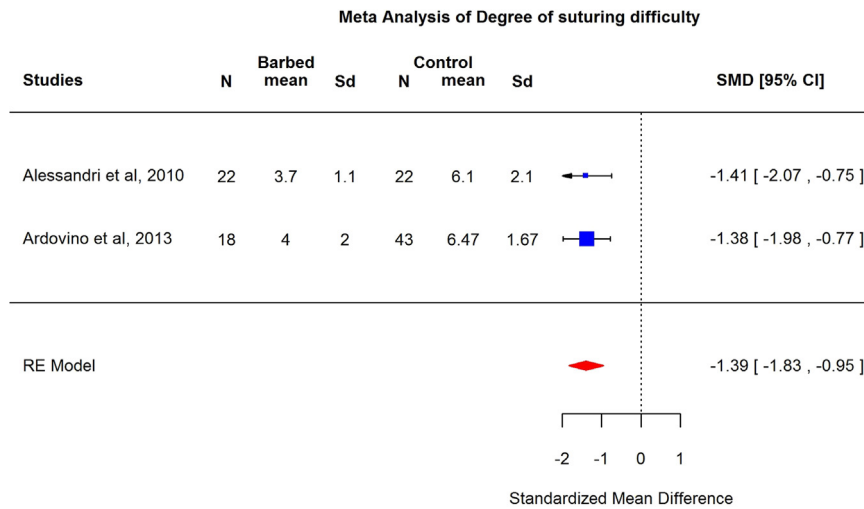


Fig. 7

A forest plot of degree of suturing difficulty of laparoscopic total hysterectomy with or without barbed suture.



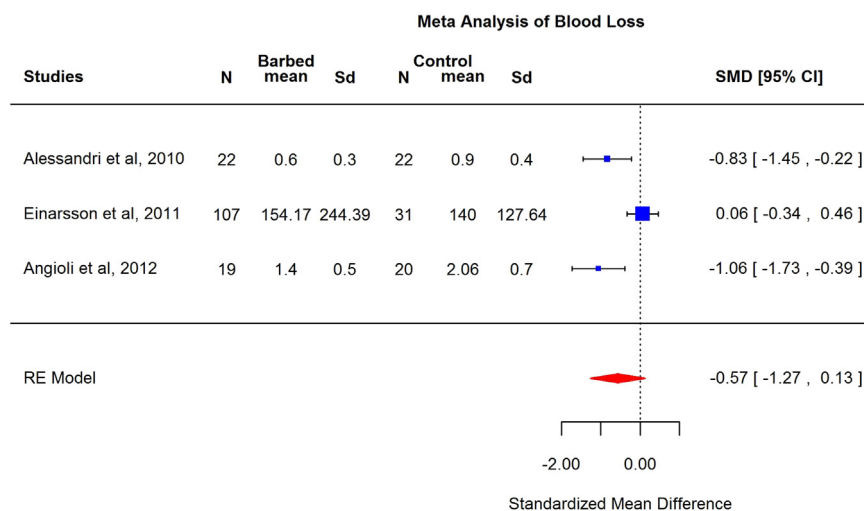
the vaginal vault, the authors found that the use of barbed suture was associated with decreased blood loss and surgical time [12]. Minor and major complications in the 2 groups of patients were similar.

Two randomized trials clearly showed that the use of barbed sutures facilitated laparoscopic suturing (Fig. 7). Another advantage of barbed suture is it maintains tension of the suture line during suturing. The presence of the barbs allows good approximation of the tissue at the beginning of suturing leading to early hemostasis. The disadvantage of the use of barbed suture is that it costs more than that of the conventional suture. However, the clinical benefits might outweigh this disadvantage. With increasing demand of its use, the cost may decrease over time.

Postoperative adhesion formation with the use of barbed suture is similar to that of conventional suture [13]. However, the barbs tend to stick to the tissue [14,15]. In 1 report, a 4-cm tail of a barbed suture was attached to the bowel mesentery and pulled tightly across the bowel causing small bowel obstruction [14]. Cutting the barbed suture flush to the tissue might be helpful. To prevent suture retraction, the LAPRA-TY clip (Ethicon Inc.) can be applied on the tail of the suture. Alternatively, an extra 1 or 2 loops of sutures can be added and the suture cut flush to the tissue. The last suture bite should be liberal. This is to prevent unraveling of the suture that might lead to a long protruding tail that can tangle the bowel. The sutured tissue is then covered with the peritoneum or

Fig. 8

A forest plot of estimated blood loss of laparoscopic myomectomy with or without barbed suture.



a sheath of oxidized regenerated cellulose (Surgicel, Ethicon Inc.) [9].

We conclude that the use of barbed suture facilitates laparoscopic suturing of myomectomy incision and closure of the vaginal vault. Its use is associated with a reduced operative time of laparoscopic myomectomy.

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