

Vaginal Stump Characteristics after Total Abdominal Hysterectomy Using Electrosurgery versus Scalpel or Scissors for Vaginal Incision: A Randomized Controlled Trial

Chayanis Tinsopharat MD*, Krissada Paiwattananupant MD*, Navamol Lekskul MD*, Arb-aroon Lertkhachonsuk MD*, Nathpong Israngura Na Ayudhya MD*, Chatchai Treetampinich MD*, Sakda Arj-Ong Vallibhakara MD, PhD**

* Department of Obstetrics and Gynecology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

** Section for Clinical Epidemiology and Biostatistics, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Objective: To compare the vaginal stump characteristics following total abdominal hysterectomy between two vaginal incision techniques, electrosurgery versus scalpel or scissors.

Material and Method: A randomized single-blind controlled trial was performed in 80 patients scheduled to undergo total abdominal hysterectomy for benign conditions. Either sharp instrument (scalpel or scissors) or electrosurgery was used for vaginal incision following standard surgical technique for total abdominal hysterectomy. The main outcome measures were the vaginal stump characteristics determined by the degree of vaginal mucosal approximation and the presence of vaginal granulation at 6-week postoperatively.

Results: Six weeks after surgery, the number of patients with incomplete mucosal approximation following electrosurgical technique was 11 (27.5%), as compared to 8 (20%) ($p = 0.43$) in the scalpel/scissors technique group. The incidences of vaginal granulation in the scalpel/scissors group and electrosurgical group were 10% and 22.5%, respectively.

Conclusion: The vaginal stump characteristics at six weeks following total abdominal hysterectomy between two vaginal incision techniques were not statistically significantly different.

Keywords: Colpotomy, Electrosurgery, Granulation, Hysterectomy, Vaginal stump

J Med Assoc Thai 2016; 99 (12): 1277-82

Full text. e-Journal: <http://www.jmatonline.com>

Total abdominal hysterectomy is a commonly performed major gynecologic operation. Diverse surgical techniques were comprehensively applied in this procedure. The vaginal stump closure^(1,2), suture materials^(3,4), and mode of hysterectomy⁽⁵⁾ were studied and incontrovertibly verified to affect the vaginal stump healing. One of the novel surgical techniques is performing vaginal incision by electrosurgical equipment instead of the classic approach with scalpel or scissors, especially in laparoscopic surgery⁽⁶⁾. Although both techniques have been widely practiced, there has never been a comparative study to validate the superiority in terms of vaginal stump healing.

Electrosurgery creates a desired tissue effect by delivering high-frequency alternating current through different electrodes, monopolar or bipolar, that manipulate electrons to create sufficient current density in living tissue. Cut waveform is a continuous output

current used to cut and desiccate tissue. Coagulation waveform is a highly-interrupted output, reserved for surface fulguration, to control small open bleeders and superficial coagulation. Blend mode is a moderately-interrupted output⁽⁷⁾. Using electrosurgery in coagulation mode during colpotomy has been used by some gynecologists for bloodless dissection. Nevertheless, vaginal stump healing after electrosurgery in coagulation mode is a contentious issue while the classical dissection by scalpel or scissors is known.

The objective of the present study was to compare two vaginal incision techniques, electrosurgery with coagulation mode and scalpel or scissors, based on the vaginal stump characteristics at 6-week interval after total abdominal hysterectomy. The stump characteristics were determined by an approximation of vaginal mucosa and a presence of vaginal granulation.

Material and Method

This randomized single-blind parallel controlled trial enrolled 80 patients scheduled for total abdominal hysterectomy for benign conditions between March and October 2015. The study was approved by

Correspondence to:

Paiwattananupant K, Department of Obstetrics and Gynecology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand.

Phone: +66-91-9596415, Fax: +66-2-2011416

E-mail: p.krissada@gmail.com

the Ethic Committee on Human Rights Related to Research Involving Human Subjects, based on the Declaration of Helsinki, the Department of Obstetrics and Gynecology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand (IRB.ID 02-58-06). All participants provided written informed consent with guarantees of confidentiality.

The inclusion criteria were patients 15 to 60 years of age, scheduled for total abdominal hysterectomy for benign conditions, who were willing to participate in the study. Women with underlying diseases or conditions that affect wound healing process, such as connective tissue diseases, autoimmune diseases, uncontrolled diabetes mellitus, chronic renal failure, cirrhosis, severe malnutrition, or bedridden status were excluded. Additionally, the patients who were not able to return for follow-up at the postoperative outpatient clinic were also excluded.

On admission, each woman was allocated into one of the two groups, based on computer-generated randomization, preliminarily prepared in sealed opaque envelopes. The upper vagina would be incised with a scalpel or scissors in one group, and with electrosurgery in the other group, see Fig. 1.

Preoperative prophylactic antibiotics and standard sterile techniques were used in all cases. All of the operations were performed by experienced, board-certified gynecologists. The surgical techniques of total abdominal hysterectomy⁽⁸⁾ were standardized among surgeons. In the scalpel/scissors group, after the uterus was pulled cephalad and the cervix was identified by palpation, the upper vaginal was circumferentially

incised using scalpel or scissors. The electrosurgery group had an upper vaginal incised using monopolar electrode at 30 to 50 watts of current power setting in a coagulation mode⁽⁷⁾. After colpotomy, the vagina was cleaned with povidone-iodine. Allis forceps were used to grasp opened vaginal edges in both groups, instead of compressing the vaginal with hysterectomy clamps during suturing. The lateral vaginal cuff angles were sutured with atraumatic 1-0 polyglactin in figure-of-eight stitches in order to incorporate the full thickness of the vaginal wall and include the cardinal-uterosacral complex. Additional full thickness figure-of-eight stitches were placed about 1 cm in depth and 1 cm apart between stitches to completely close the stump. Pelvic irrigation was carried out with sterile saline solution, standard abdominal closure was achieved without suturing the pelvic peritoneum. All patients received the consistent postoperative care.

One week in advance, we reminded all patients of their postoperative follow-ups, which were arranged at our outpatient clinic at 6-week postoperatively. They were asked to indicate any possible abnormal symptoms such as fever, vaginal discharge, vaginal bleeding, pelvic pain, genitourinary symptoms, or sexual problems. A speculum examination was done to inspect the vaginal stump by the author (Tinsoparat C) who was unaware of the type of surgical technique. The primary outcome, vaginal stump characteristic after total abdominal hysterectomy, was categorized into two types, complete and incomplete mucosal approximation. Complete vaginal stump approximation was defined as an absence of mucosal separation, suture materials, or granulation tissues at vaginal stump. Incomplete mucosal approximation was diagnosed when mucosal separation or unabsorbed suture materials or vaginal granulations were evident. Vaginal granulation was stipulated as small, visible, painless, red or pink, granular to polypoid lesions protruding from the mucosal surface. Patients who had non-bleeding vaginal granulations at 6-week post-operation were counseled for observational management and arranged for a follow-up two weeks later. Bleeding vaginal granulation was treated with topical silver nitrate solution. The lesions found at 8-week post-operation were treated with topical silver nitrate solution every one or two weeks, until resolution⁽⁸⁾. If the lesions persisted after four to six silver nitrate applications, an excisional biopsy was performed and sent for pathological studies. Detected infected vaginal stumps were treated with oral antibiotics.

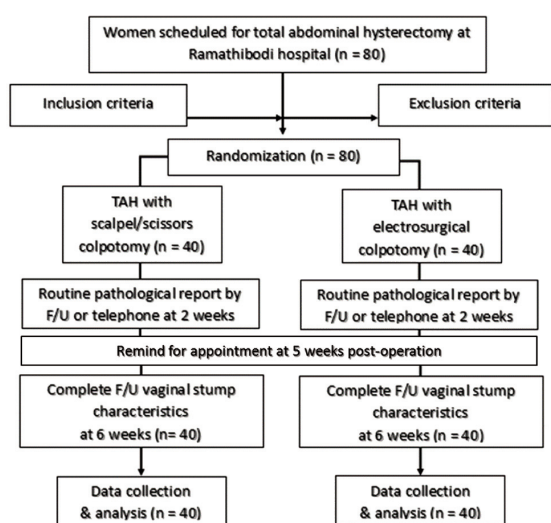


Fig. 1 Flow of the study.

Table 1. Patient demographic data and clinical characteristics[†]

	Scalpel/scissors (n = 40)	Electrosurgery (n = 40)	<i>p</i> -value
Age (year)	46.1±6.2	48.0±5.9	0.15
Weight (kg)	61.7±11.2	63.9±12.8	0.42
Height (cm)	155.7±5.6	156.3±5.5	0.63
BMI (kg/m ²)	25.5±4.8	26.1±4.9	0.56
Operation time (minute)	121.9±36.5	136.6±39.1	0.09
Length of hospital stay (day)	4.0±1.2	4.0±0.79	0.74
Estimated blood loss (ml)	250 (50 to 1,400)	225 (30 to 1,500)	0.56*

BMI = body mass index

[†] Values are mean ± SD except estimated blood loss using median (min to max)

* Mann-Whitney U test

The data was analyzed with a computerized statistical package (PASW statistics 18; SPSS Inc., 2009, Chicago, IL). The Chi-squared test was used for categorical variable analysis and continuous variables were evaluated with t-test or Mann-Whitney U test. The statistically significant was determined by *p*-value <0.05.

Results

Eighty women were sequentially randomized enrollment in the present study: 40 patients allocated to the scalpel or scissors group and 40 to the electrosurgical group. None of the participants was excluded after randomization. The patients' baseline demographic and clinical characteristic data were listed in Table 1. The indications for hysterectomy were similar in both groups as summarized in Table 2. The mean operative times were 121.9 minutes in the scalpel/scissors group and 136.6 minutes in the electrosurgical group (*p*-value = 0.09). The mean length of hospital stay was 4.0 days in the scalpel or scissors group and 4.0 days in the electrosurgical group (*p*-value = 0.74). The median estimated blood loss was 250 mL in the scalpel/scissors group and 225 mL in the electrosurgical group (*p*-value = 0.56).

Six weeks after the operation, 19 patients (23.8%) had incidences of incomplete vaginal mucosal approximation, eight (42%) in the scalpel or scissors group and 11 (58%) in the electrosurgical group (Table 3). However, it was not a statistically significant difference (*p*-value = 0.43). The overall incidence of vaginal granulation was 16.25%. The incidence of vaginal granulation in the scalpel/scissors group and electrosurgical group six weeks after surgery were 10% and 22.5%, respectively. Symptomatic patients were treated with topical silver nitrate solution every one to two weeks according to the research protocol and

Table 2. Indications for hysterectomy

Indications	Scalpel/scissors n (%)	Electrosurgery n (%)	<i>p</i> -value
Myoma uteri	19 (47.5)	24 (60.0)	0.14
Adenomyosis/ endometriosis	16 (40.0)	8 (20.0)	
Others*	5 (12.5)	8 (20.0)	

* Ovarian tumor, prophylactic surgery for breast cancer

Table 3. Vaginal stump characteristics at 6 weeks after total abdominal hysterectomy

Vaginal mucosal approximation	Scalpel/scissors (n = 40)	Electrosurgery (n = 40)	<i>p</i> -value
Complete (%)	32 (80.0)	29 (72.5)	0.43

almost all of the lesions resolved after silver nitrate treatment. Only one patient in the electrosurgical group had persistent vaginal granulation after six weekly silver nitrate application. Excisional biopsy was required to exclude prolapsed fallopian tube. Nevertheless, the granulation tissue was pathologically confirmed.

Three patients had vaginal stump infection, one in the scalpel group and two in the electrosurgical group. All of them resolved after oral antibiotics treatment. Serious complications such as a vaginal stump dehiscence, gastrointestinal, and urinary tract injury were not experienced six weeks postoperatively⁽⁹⁾.

Discussion

The results from the present study showed the vaginal stump characteristics, complete and incomplete approximation, were not different between the scalpel/scissors group and the electrosurgical group, after the standardized surgical protocol. In addition, the author

found a higher incidence of granulation following electrosurgical technique. Only a few cases of vaginal stump infection, considered as a minor complication, were reported (3.75%).

The present study, which is among the previously few randomized controlled trials, focused on the vaginal cuff healing, and comparing between the effects of sharp dissection and electrosurgery, even though, electrosurgery has been used for decades. The physician, who was unaware of the patients' allocation, is the only person who assessed the vaginal stump characteristics and collected all data at the postoperative follow-up visit in order to minimize inter observer variability. Additionally, none of the patients were lost to follow-up because of the reminding phone call protocol. The limitation of the present study was the new vaginal stump characteristic evaluation criteria that we had just developed and validated due to a lack of prior studies on vaginal healing process. Keratinized skin healing may differ from vaginal healing, non-keratinize epithelium, and a result of the different environment⁽¹⁰⁾. The vaginal wound is generally unexposed to air, and is situated in a moist environment with bacterial flora. Owing to the power of the study, the incidence of rare complications could not be concluded.

In the present study, vaginal stump characteristic was defined as the approximation and granulation of vaginal stump based on a few studies on human vaginal healing process. Persistent vaginal stump granulation was frequently used as an indicator of postoperative vaginal stump healing in many previous studies^(4,8). The progressive maturation of granulation tissue is one of the normal wound healing processes⁽¹¹⁾. Normally, repairing process of approximated surgical wounds consists primarily of re-epithelialization in less than 48 hours with minimal fibroplasia and granulation tissue formation. Persistence of granulation tissue beyond wound surface is the result of incomplete re-epithelialization and representation of poor healing. Re-epithelialization process may be disturbed by many factors including incomplete wound approximation, inadequate hemostasis, presence of inflammatory cells at healing site, and proliferation and migration of epithelial cells adjacent to the wound, host immune system and wound environment⁽¹²⁾. Still, some patients had poor stump healing without granulation. The vaginal stump approximation evaluation was put into practice to detect the patients with poor mucosal healing without the presence of granulation.

The study established that there were 20% versus 27.5% of incomplete mucosal approximation in the scalpel/scissors group and the electrosurgical group, respectively. There was no statistically significant difference in vaginal stump characteristics between both groups (p -value=0.43). Meticulous approximation of the healthy vaginal tissue by suitable suturing technique as directed in the protocol could relate to the equivalent vaginal stump characteristics between both groups. Recently, Valença-Filipe et al studied a dissection technique for abdominoplasty, utilizing a scalpel versus diathermocoagulation on coagulation mode and comparable outcomes such as wound healing was validated⁽¹³⁾. This was despite that the abdominal skin was keratinized, which was different from non-keratinized epithelium of the vagina.

On the contrary, there was a higher incidence of granulation in the electrosurgical group than the scalpel/scissors group. From recent studies, the occurrence of vaginal granulation after electrosurgical technique was generally lower. Azadi et al reported that the incidence of vaginal stump granulation emerging after electrosurgical technique was 6.4%, six weeks after surgery⁽⁶⁾. Manyoda et al reported 32% of granulation formation in the scalpel-incised vaginal stump closed by polyglactin⁽³⁾. Electrosurgery caused more vaginal tissue destruction than sharp colpotomy leading to poor healing of vaginal cuff, which may explain the rising incidence of granulation tissue in the electrosurgical group⁽⁵⁾.

There was no serious complication in the present study, especially the highly concerned vaginal cuff dehiscence. The mode of surgery was one of the risk factors of vaginal cuff dehiscence, which developed at the higher rate ensuing robot-assisted laparoscopic hysterectomy (4.12%)⁽¹⁴⁾ and laparoscopic hysterectomy (0.64 to 0.75%)^(5,15-17). The use of electrosurgery to accomplish the vaginal colpotomy in both surgical approaches was a potential factor to increase the rate of vaginal cuff dehiscence⁽⁵⁾. The vaginal cuff was sutured in proper places with secure knot tying under clear direct vision in total abdominal hysterectomy, resulting in higher achievement of full thickness closure⁽⁵⁾.

In conclusion, the vaginal stump characteristics six weeks following total abdominal hysterectomy between two vaginal incision techniques, electrosurgery versus scalpel or scissors, were not statistically significantly different. The electrosurgery on coagulation mode may be an interesting approach to attain colpotomy, with beneficial hemostasis, 'a

bloodless dissection', a potentially shorter operative time, and a lower risk of hematoma^(13,18-20). This technique is safe, particularly in the hands of experienced surgeons. However, abiding vaginal healing process after six weeks and long-term complications should be further studied.

What is already known on this topic?

Vaginal stump healing has the inconvertible effect of the technique of vaginal closure, suture materials, and mode of hysterectomy. Using electro-surgery during colostomy was practiced by some gynecologist. However, there are few studies in vaginal characteristics comparing between both techniques - scalpel/scissors and electro-surgery.

What this study adds?

This study evaluated the vaginal stump characteristics as the effect of using electro-surgery and scalpel or scissors during colpotomy. The vaginal stump characteristics six weeks post operation were not statistically different between both groups. However, there were higher incidence of granulation following electro-surgical than scalpel or scissors techniques.

Acknowledgments

The authors would like to thank Mrs. Umaporn Udomsubpayakul for initial guided on statistical analysis.

Potential conflicts of interest

None.

References

1. Colombo M, Maggioni A, Zanini A, Rangoni G, Scalabrino S, Mangioni C. A randomized trial of open versus closed vaginal vault in the prevention of postoperative morbidity after abdominal hysterectomy. *Am J Obstet Gynecol* 1995; 173: 1807-11.
2. Aharoni A, Kaner E, Levitan Z, Condrea A, Degani S, Ohel G. Prospective randomized comparison between an open and closed vaginal cuff in abdominal hysterectomy. *Int J Gynaecol Obstet* 1998; 63: 29-32.
3. Manyonda IT, Welch CR, McWhinney NA, Ross LD. The influence of suture material on vaginal vault granulations following abdominal hysterectomy. *Br J Obstet Gynaecol* 1990; 97: 608-12.
4. Tannirandorn Y, Tuchinda K. Vaginal vault granulations after total abdominal hysterectomy using polyglactin for vault closure. *J Med Assoc Thai* 2001; 84: 693-6.
5. Hur HC, Guido RS, Mansuria SM, Hacker MR, Sanfilippo JS, Lee TT. Incidence and patient characteristics of vaginal cuff dehiscence after different modes of hysterectomies. *J Minim Invasive Gynecol* 2007; 14: 311-7.
6. Azadi A, Lipetskaia L, Yeganeh T, Tate SB, Diaz SV. Granulation tissue formation at the vaginal cuff after total laparoscopic hysterectomy or davinci assisted total hysterectomy with uterosacral ligament colpopexy for surgical correction of pelvic organ prolapse. *J Minim Invasive Gynecol* 2011; 18 (Suppl): S141.
7. Alkatout I, Schollmeyer T, Hawaldar NA, Sharma N, Mettler L. Principles and safety measures of electro-surgery in laparoscopy. *JLS* 2012; 16: 130-9.
8. Jones HW. Abdominal hysterectomy. In: Rock JA, Jones HW, editors. *Te Linde's operative gynecology*. 10th ed. Philadelphia: Lippincott Williams & Wilkins; 2008: 727-42.
9. Saropala N, Ingsirorat C. Conservative treatment of vaginal vault granulation tissue following total abdominal hysterectomy. *Int J Gynaecol Obstet* 1998; 62: 55-8.
10. Clarke-Pearson DL, Geller EJ. Complications of hysterectomy. *Obstet Gynecol* 2013; 121: 654-73.
11. Abramov Y, Golden B, Sullivan M, Botros SM, Miller JJ, Alshahrour A, et al. Histologic characterization of vaginal vs. abdominal surgical wound healing in a rabbit model. *Wound Repair Regen* 2007; 15: 80-6.
12. Barbul A, Efron DT, Kavalukas SL. Wound healing. In: Brunnicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, editors. *Schwartz's principle of surgery*. 10th ed. New York: McGraw-Hill; 2015: 223-48.
13. Lipscomb GH. Wound healing, suture material, and surgical instrumentation. In: Rock JA, Jones HW, editors. *Te Linde's operative gynecology*. 10th ed. Philadelphia: Lippincott Williams & Wilkins; 2008: 226-42.
14. Valença-Filipe R, Martins A, Silva Á, Váscónez LO, Amarante J, Costa-Ferreira A. Dissection technique for abdominoplasty: a prospective study on scalpel versus diathermocoagulation (Coagulation Mode). *Plast Reconstr Surg Glob Open* 2015; 3: e299.
15. Kho RM, Akl MN, Cornella JL, Magtibay PM,

- Wechter ME, Magrina JF. Incidence and characteristics of patients with vaginal cuff dehiscence after robotic procedures. *Obstet Gynecol* 2009; 114: 231-5.
16. Agdi M, Al Ghafri W, Antolin R, Arrington J, O'Kelley K, Thomson AJ, et al. Vaginal vault dehiscence after hysterectomy. *J Minim Invasive Gynecol* 2009; 16: 313-7.
17. Hur HC, Donnellan N, Mansuria S, Barber RE, Guido R, Lee T. Vaginal cuff dehiscence after different modes of hysterectomy. *Obstet Gynecol* 2011; 118: 794-801.
18. Uccella S, Ghezzi F, Mariani A, Cromi A, Bogani G, Serati M, et al. Vaginal cuff closure after minimally invasive hysterectomy: our experience and systematic review of the literature. *Am J Obstet Gynecol* 2011; 205: 119-12.
19. Araco A, Sorge R, Overton J, Araco F, Gravante G. Postbariatric patients undergoing body-contouring abdominoplasty: two techniques to raise the flap and their influence on postoperative complications. *Ann Plast Surg* 2009; 62: 613-7.
20. Rousseau P, Vincent H, Potier B, Arnaud D, Darsonval V. Diathermocoagulation in cutting mode and large flap dissection. *Plast Reconstr Surg* 2011; 127: 2093-8.

ลักษณะของแผลในช่องคลอดหลังการผ่าตัดมดลูกทางหน้าท้องระหว่างการตัดช่องคลอดด้วยเครื่องตัดจีไฟฟ้าและการตัดด้วยมีดหรือกรรไกร: การศึกษาเชิงทดลองแบบสุ่ม

ชยนาติ ตินโสภารัตน์, กฤษดา ไพรวัดมานุพันธ์, นวมลล์ เด็กสกุล, อาบอรุณ เลิศจรสุข, ณัฐพงศ์ อิศรางกูร ณ อยุธยา, นัทรชัย ตริธรรมพินิจ, สักดา อาจองค์ วัลลิภากร

วัตถุประสงค์: เพื่อเปรียบเทียบลักษณะของแผลในช่องคลอดหลังการผ่าตัดมดลูกทางหน้าท้องระหว่างการตัดช่องคลอดสองวิธี คือ ตัดด้วยเครื่องตัดจีไฟฟ้าและการตัดด้วยมีดหรือกรรไกร

วัสดุและวิธีการ: ทำการศึกษาเชิงทดลองแบบสุ่มในผู้ป่วย 80 ราย ที่นัดมาผ่าตัดมดลูกทางหน้าท้องโดยมีข้อบ่งชี้ที่ไม่ใช่มะเร็ง แบ่งเป็นกลุ่มผู้ป่วยที่ใช้มีดหรือกรรไกรตัดช่องคลอด และกลุ่มผู้ป่วยที่ใช้เครื่องตัดจีไฟฟ้าตัดช่องคลอดภายใต้การผ่าตัดมดลูกทางหน้าท้องด้วยวิธีมาตรฐาน ผลการศึกษาหลัก คือ ลักษณะของแผลในช่องคลอดซึ่งวัดจากระดับการยึดติดกันของเยื่อผนังช่องคลอดและการเกิดเนื้อเยื่อแกรนูเลชันของแผลในช่องคลอดที่ 6 สัปดาห์ หลังผ่าตัด

ผลการศึกษา: ที่ระยะเวลา 6 สัปดาห์ หลังผ่าตัด พบว่าผู้ป่วยกลุ่มที่ใช้เครื่องตัดจีไฟฟ้าตัดช่องคลอดมีลักษณะการยึดติดกันของเยื่อผนังช่องคลอดไม่สมบูรณ์ทั้งหมด 11 ราย (27.5%) เมื่อเทียบกับกลุ่มที่ใช้มีดหรือกรรไกรตัดช่องคลอดซึ่งพบ 8 ราย (20%) ($p = 0.43$) อุบัติการณ์การเกิดเนื้อเยื่อแกรนูเลชันในช่องคลอดในกลุ่มที่ใช้มีดหรือกรรไกร และกลุ่มที่ใช้เครื่องตัดจีไฟฟ้าเท่ากับ 10% และ 22.5% ตามลำดับ

สรุป: ลักษณะของแผลในช่องคลอดที่ 6 สัปดาห์ หลังผ่าตัดมดลูกทางหน้าท้องระหว่างวิธีการตัดช่องคลอดสองวิธีไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ
