International Journal of Gynecology and Obstetrics 125 (2014) 219–222

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

CLINICAL ARTICLE

Hydrosonographic assessment of the effects of 2 different suturing techniques on healing of the uterine scar after cesarean delivery ☆

Osman Sevket [a,*], Seda Ates [a], Taner Molla [a], Fulya Ozkal [a], Omer Uysal [b], Ramazan Dansuk [a]

[a] Department of Obstetrics and Gynecology, School of Medicine, Bezmialem Vakif University, Istanbul, Turkey
[b] Department of Medical Statistics and Informatics, School of Medicine, Bezmialem Vakif University, Istanbul, Turkey

ARTICLE INFO

Article history:
Received 16 August 2013
Received in revised form 15 November 2013
Accepted 25 February 2014

Keywords:
Cesarean delivery
Hydrosonography
Scar defect
Suture technique

ABSTRACT

Objective: To compare the effects of 2 suturing techniques (single versus double layer) on healing of the uterine scar after a cesarean delivery. *Methods:* In the present randomized, prospective study, 36 women with a term pregnancy who had an elective cesarean delivery were randomly assigned to closure of the uterine incision with a single-layer locked suture or with a double-layer locked/unlocked suture. Six months after the operation, the integrity of the cesarean scar at the uterine incision site was assessed by hydrosonography. The healing ratio and the thickness of the residual myometrium covering the defect were calculated as markers of uterine scar healing. *Results:* There were no significant differences between the groups in terms of estimated blood loss, operation time, or additional hemostatic suture. However, the mean thickness of the residual myometrium covering the defect was 9.95 ± 1.94 mm after a double-layer closure and 7.53 ± 2.54 mm after a single-layer closure ($P = 0.005$). The mean healing ratio was significantly higher after a double-layer closure (0.83 ± 0.10) than after a single-layer closure (0.67 ± 0.15; $P = 0.004$). *Conclusion:* A double-layer locked/unlocked closure of the uterine incision at cesarean delivery decreases the risk of poor uterine scar healing.

1. Introduction

Cesarean delivery is one of the most common operations undertaken worldwide. Because its rate is constantly increasing, the number of women with uterine scars is also rising. A scar defect is a wedge-shaped distortion at the uterine incision site, a well-known phenomenon reported by various authors [1–7] using radiologic, ultrasonographic, endoscopic, and histologic methods. These defects reflect poor uterine scar healing and have been implicated as an etiologic factor in clinical problems such as rupture of the uterus during a subsequent pregnancy [8,9], ectopic pregnancy at the cesarean delivery scar [10,11], cesarean scar endometriosis [12], secondary infertility [13,14], postmenstrual spotting [15], and dysmenorrhea [4].

In almost any surgical wound, the suturing technique and the mechanical forces affecting the wound area are the main determinants of the ultimate integrity of the incision site. Previous studies have found no association between a particular uterotomy closure technique and poor uterine scar healing [16]. The present prospective, randomized study was designed to analyze the effects of single-layer and double-layer closure of the uterine incision on cesarean scar formation.

2. Materials and methods

The present prospective, randomized cohort study was conducted at the Department of Obstetrics and Gynecology, Bezmialem Vakif University, Istanbul, Turkey, from January 1, 2012, to February 28, 2013. The exclusion criteria were a history of previous uterine surgery, multiple pregnancies, prematurity (pregnancy duration 36 weeks or less), cervical dilatation of more than 5 cm, and continuation of active labor for more than 5 hours [17]. The study was approved by the Research and Ethics Committee of Bezmialem Vakif University Hospital, and written informed consent was obtained from all participants. Random Number Generator version 1.0 (Segobit Software, Issaquah, WA, USA) was used to randomly assign the participants in a 1:1 ratio to single-layer or double-layer closure of the uterine incision.

All cesarean deliveries were performed under endotracheal general anesthesia using a slightly modified Misgav Ladach technique [18]. After delivery of the fetus and removal of the placenta, the internal cervical ostium of patients with a closed cervix was dilated digitally by introducing a forefinger into the cervical canal to form an open passage to the vagina [19]. In patients randomly assigned to have a single-layer closure, a holding stitch stabilized the right corner; the whole thickness

☆ Based on an abstract presented at the 11th Obstetrics and Gynecology National Congress; May 2013; Antalya, Turkey. Şevket O, Ateş S, Molla T, Özkal F, Uysal Ö, Dansuk R. Hydrosonographic assessment of two different suturing techniques on healing of the uterine scar after a cesarean section.

* Corresponding author at: Bezmialem Vakif University, Adnan Menderes Bul., Vatan Cad., Fatih, Istanbul 34093, Turkey. Tel.: +90 5335235246.
E-mail address: sevketosman@gmail.com (O. Sevket).

http://dx.doi.org/10.1016/j.ijgo.2013.11.013
0020-7292/

of the uterine wall (including the endometrium) was then sutured with a single-layer continuous locking stitch using Vicryl 1.0 (Ethicon, Somerville, NJ, USA). Patients randomly assigned to a double-layer closure had an initial closure that was identical to the single-layer closure described earlier. An additional layer of Vicryl 1.0 suture with a continuous unlocked stitch was then used to imbricate the first layer. Additional single sutures for hemostasis were added as required in both groups. The surgical technique included exteriorization of the uterus and visceral and parietal peritonization, apposition of the rectus musculature, and closing of the subdermal space in all patients (performed by S.A.).

Every patient received a prophylactic dose of antibiotics (1 g intramuscular cefazolin sodium). An intravenous infusion of 20 U of oxytocin was administered intraoperatively and again during the early postoperative period.

All patients started breastfeeding during the early postoperative period with the help of a nurse who specialized in the care of newborns. Each patient was discharged within 3 days and scheduled for a saline contrast hydrosonography (instillation of saline into the uterine cavity during scanning) at 6 months after the cesarean delivery [20].

The hydrosonographic examinations were performed with a 7-MHz covered ultrasound vaginal probe (Voluson 730 Expert; GE Medical Systems, Zipf, Austria) after complete emptying of the bladder [21]. The ultrasound examiner (O.S.) was blinded to the closure technique. The incision site was viewed longitudinally. In all women, 3 parameters were measured: the thickness of the residual myometrium covering the scar, the thickness of the anterior myometrium adjacent to the scar, and the thickness of the posterior uterine wall at the level of the uterine incision (Figs. 1 and 2). A scar defect was defined as a deviation of at least 1 mm from the full thickness of the anterior uterine wall as measured on the ultrasound image. The healing ratio was calculated as the thickness of the residual myometrium covering the defect, divided by the sum of the thickness of the residual myometrium covering the defect and the height of the wedge-shaped defect.

The statistical analysis was performed with SPSS version 10.7.0 (IBM, Armonk, NY, USA). Continuous variables with normal distribution were compared with the Fisher exact test. All categoric variables were compared with the Mann–Whitney *U* test. $P < 0.05$ was considered statistically significant.

3. Results

The study included 36 patients, with 18 assigned to single-layer closure and 18 assigned to double-layer closure. In total, 13 patients in the single-layer group and 2 patients in the double-layer group were lost at follow-up because the patients had been referred to the study hospital from different cities in the region. The demographic variables—mean age, pregnancy duration, number of prior vaginal deliveries, duration of active labor, cervical dilatation at during cesarean delivery, and birth weight—were similar in the 2 groups (Table 1).

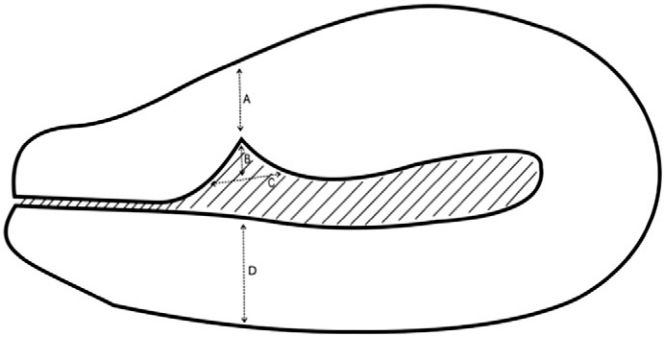

Fig. 1. Healing ratio. A. Thickness of the residual myometrium covering the defect. B. Height of the defect. C. Length of the defect. D. Posterior wall thickness.

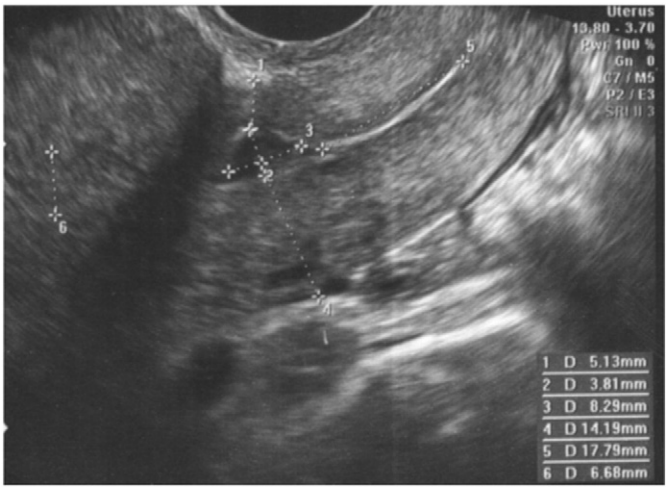

Fig. 2. Sonographic appearance of a poorly healed uterine scar following a cesarean incision. 1. Thickness of the residual myometrium covering the defect. 2. Height of the defect. 3. Length of the defect. 4. Posterior wall thickness. 5. Thickness of the endometrium. 6. Length of the cervix.

Estimated blood loss, duration of surgery, and number of additional hemostatic sutures were not significantly different between the groups (Table 2). However, the mean thickness of the residual myometrium covering the defect differed significantly (double-layer closure, 9.95 ± 1.94 mm; single-layer closure, 7.53 ± 2.54 mm; $P = 0.005$). Moreover, the mean healing ratio was significantly higher in the group with double-layer closure (0.83 ± 0.10) than in the single-layer closure group (0.67 ± 0.15, $P = 0.004$) (Table 2).

4. Discussion

The reasons for poor healing of a uterine incision following cesarean delivery remain unknown; however, known risk factors for poor healing include the number of previous cesarean deliveries, maternal age, position of the uterus, trial of labor, induction of labor, and type and technique of the uterus closure [17]. A systematic review [16] of 21 studies found that the prevalence of a uterine scar defect varied between 20% and 86% with a median of 56%. This variability may be attributable to interobserver variability, differences in the indications for cesarean delivery, and differences in the postoperative evaluations (different postoperative time intervals and different imaging techniques) [2,7,22,23].

In the present study, hydrosonographic examination at 6 months after cesarean delivery was used to compare the cesarean scar formation with 2 different surgical techniques, namely double-layer uterine closure versus single-layer uterine closure. Even the smallest deviations from the normal shape of the anterior isthmic wall are better evaluated by hysterosonography than by transvaginal ultrasound

Table 1
Demographic characteristics of the participants at delivery.[a]

Parameter	Single-layer closure (n = 15)	Double-layer closure (n = 16)	*P* value
Maternal age, y	29.7 ± 6.5	29.4 ± 7.3	0.781
Pregnancy duration at cesarean delivery, wk	38.6 ± 0.8	39.0 ± 1.2	0.340
Number of previous vaginal deliveries	0.7 ± 1.4	0.9 ± 1.3	0.469
Duration of active labor, h[b]	0.7 ± 1.2	0.5 ± 0.9	0.520
Cervical dilatation at cesarean delivery, cm	2.0 ± 1.5	2.2 ± 1.4	0.653
Birth weight, g	3443 ± 432	3388 ± 380	0.453

[a] Values are given as mean ± SD.
[b] Number of hours with regular contractions.

Table 2
Outcomes after single- versus double-layer closure of the uterine incision following cesarean delivery.[a]

Parameter	Single-layer closure (n = 15)	Double-layer closure (n = 16)	*P* value
Estimated blood loss, mL	667 ± 329	681 ± 280	0.843
Duration of surgery, min	44,6 ± 4.9	43.0 ± 4.9	0.240
Number of additional hemostatic sutures	1.2 ± 1.0	1.1 ± 1.3	0.453
Height of the defect, mm	3.5 ± 1.5	2.0 ± 1.2	0.007
Length of the defect, mm	6.2 ± 2.6	3.6 ± 2.3	0.008
Thickness of the residual myometrium covering the defect, mm	7.5 ± 2.5	9.9 ± 1.9	0.005
Myometrial thickness adjacent to the scar, mm	10.0 ± 2.1	12.7 ± 4.4	0.048
Thickness of the endometrium, mm	5.5 ± 3.1	5.7 ± 2.3	0.429
Healing ratio, %[b]	67 ± 15	83 ± 10	0.004

[a] Values are given as mean ± SD.
[b] Thickness of the residual myometrium covering the defect, divided by the sum of the thickness of the residual myometrium covering the defect and the height of the wedge-shaped defect.

[20]. At 6 months after a cesarean delivery, the zonal anatomy of the uterus is restored; however, the time needed for complete healing of the uterine scar after a transverse uterine incision is unclear [24].

Previous studies [19,20,25] have considered the presence of a uterine scar defect, a decreased thickness of the residual myometrium covering the defect, presence of a large scar defect, and a lower healing ratio as markers of poor scar healing after a cesarean delivery. In a recent review, Roberge et al. [16] did not find an association between a large scar defect and single- or double-layer closure. However, these studies were not consistent in their definition of uterine scar defects and in the time interval between cesarean delivery and evaluation of the scar. In the present study, we used a lower healing ratio and a decreased thickness of the residual myometrium covering the defect, rather than presence of a large scar defect, as markers of poor uterine scar healing. Women with a double-layer uterine closure had higher uterine scar healing ratios than those with a single-layer uterine closure. The present results are consistent with those by Glavind et al. [26], who also showed that a single-layer closure decreases the uterine scar-healing ratio compared with a double-layer closure.

In a randomized transvaginal ultrasonography study comparing single- and double-layer uterotomy, Hamar et al. [25] found no differences in the thickness of the residual myometrium covering the defect. Glavind et al. [26], however, showed in a retrospective study that a single-layer uterotomy closure leads to a decreased thickness of the residual myometrium covering the defect compared with a double-layer closure. Similarly, in the present study the residual myometrium covering the defect was thinner among women who had undergone single-layer uterine closure than among those with a two-layer uterine closure.

In 2008, a review [27] reported that a single-layer closure is associated with reductions in blood loss and operative time. By contrast, Hamar et al. [25] found no differences in mean blood loss and operative time when comparing single- and double-layer uterine closure. In the present study, mean blood loss and operative time were also similar with the 2 methods of closure.

Uterine rupture is a life-threatening complication of cesarean delivery. To our knowledge, only 1 investigative study [28] found a possible association between scar defects seen by ultrasonography in nonpregnant women and uterine rupture or dehiscence in their subsequent pregnancies. A significant difference in the proportions of uterine rupture and uterine dehiscence was found between women with small defects and those with large scar defects, but the authors added that these findings should not lead to any changes in clinical practice [28]. These findings are in contrast to those from a systematic review and meta-analysis [29] that evaluated the association between a single- or double-layer uterotomy closure and the risk of uterine rupture. These authors [29] concluded that a single-layer locked closure might increase the risk of uterine rupture in women attempting a trial of labor in a future pregnancy, compared with a double-layer closure of the uterine incision.

A possible limitation of the present study is the fact that the participants were not examined on a particular day of the menstrual cycle. This omission may be inconsequential, however, because the average endometrial thickness was similar in the 2 groups ($P = 0.429$). Also, the healing ratio and the thickness of the residual myometrium covering the defect were used as markers of poor scar healing, and these measures are unlikely to be affected by the thickness of the endometrium.

The present study demonstrated that a double-layer locked/unlocked closure of the uterine incision at cesarean delivery decreases the risk of poor uterine scar healing as identified by hydrosonography. Controversy exists about the association between the risk of uterine dehiscence or rupture, cesarean scar pregnancy or abnormal placental implantation, and poor uterine scar healing. A simple change in the cesarean surgical technique such as use of a double-layer locked/unlocked closure may prevent the occurrence of such unwanted complications in a subsequent pregnancy; however, this hypothesis needs further investigation in a large series of patients and multicenter trials.

Conflict of interest

The authors have no conflicts of interest.

References

[1] Maldjian C, Adam R, Maldjian J, Smith R. MRI appearance of the pelvis in the post cesarean-section patient. Magn Reson Imaging 1999;17(2):223–7.
[2] Chen HY, Chen SJ, Hsieh FJ. Observation of cesarean section scar by transvaginal ultrasonography. Ultrasound Med Biol 1990;16(5):443–7.
[3] Petrikovsky BM. Endoscopic assessment of the integrity of the postcesarean uterine wall before a trial of labor. Transcervical Endoscopy Registry. J Reprod Med 1994;39(6):464–6.
[4] Morris H. Surgical pathology of the lower uterine segment caesarean section scar: is the scar a source of clinical symptoms? Int J Gynecol Pathol 1995;14(1):16–20.
[5] Kiss D, Györik J, Rajkovits K. Histological examination of uterus healing following cesarean section. Zentralbl Gynakol 1978;100(5):309–12.
[6] Gotoh H, Masuzaki H, Yoshida A, Yoshimura S, Miyamura T, Ishimaru T. Predicting incomplete uterine rupture with vaginal sonography during the late second trimester in women with prior cesarean. Obstet Gynecol 2000;95(4):596–600.
[7] Armstrong V, Hansen WF, Van Voorhis BJ, Syrop CH. Detection of cesarean scars by transvaginal ultrasound. Obstet Gynecol 2003;101(1):61–5.
[8] Rozenberg P, Goffinet F, Philippe HJ, Nisand I. Thickness of the lower uterine segment: its influence in the management of patients with previous cesarean sections. Eur J Obstet Gynecol Reprod Biol 1999;87(1):39–45.
[9] Rozenberg P, Goffinet F, Phillippe HJ, Nisand I. Ultrasonographic measurement of lower uterine segment to assess risk of defects of scarred uterus. Lancet 1996;347(8997):281–4.
[10] Wang W, Long W, Yu Q. Complication of cesarean section: pregnancy on the cicatrix of a previous cesarean section. Chin Med J (Engl) 2002;115(2):242–6.
[11] Haimov-Kochman R, Sciaky-Tamir Y, Yanai N, Yagel S. Conservative management of two ectopic pregnancies implanted in previous uterine scars. Ultrasound Obstet Gynecol 2002;19(6):616–9.
[12] Nominato NS, Prates LF, Lauar I, Morais J, Maia L, Geber S. Caesarean section greatly increases risk of scar endometriosis. Eur J Obstet Gynecol Reprod Biol 2010;152(1):83–5.
[13] Fabres C, Arriagada P, Fernández C, Mackenna A, Zegers F, Fernández E. Surgical treatment and follow-up of women with intermenstrual bleeding due to cesarean section scar defect. J Minim Invasive Gynecol 2005;12(1):25–8.
[14] Van Horenbeeck A, Temmerman M, Dhont M. Cesarean scar dehiscence and irregular uterine bleeding. Obstet Gynecol 2003;102(5 Pt 2):1137–9.
[15] Bij de Vaate AJ, Brölmann HA, van der Voet LF, van der Slikke JW, Veersema S, Huirne JA. Ultrasound evaluation of the Cesarean scar: relation between a niche and postmenstrual spotting. Ultrasound Obstet Gynecol 2011;37(1):93–9.
[16] Roberge S, Boutin A, Chaillet N, Moore L, Jastrow N, Demers S, et al. Systematic review of cesarean scar assessment in the nonpregnant state: imaging techniques and uterine scar defect. Am J Perinatol 2012;29(6):465–71.
[17] Vikhareva Osser O, Valentin L. Risk factors for incomplete healing of the uterine incision after caesarean section. BJOG 2010;117(9):1119–26.
[18] Holmgren G, Sjöholm L, Stark M. The Misgav Ladach method for cesarean section: method description. Acta Obstet Gynecol Scand 1999;78(7):615–21.
[19] Yazicioglu HF, Sevket O, Ekin M, Ozyurt O, Aygun M. Incomplete healing of the uterine incision after cesarean section: is it preventable by intraoperative digital dilatation of the internal cervical ostium? Gynecol Obstet Invest 2012;74(2):131–5.

[20] Osser OV, Jokubkiene L, Valentin L. Cesarean section scar defects: agreement between transvaginal sonographic findings with and without saline contrast enhancement. Ultrasound Obstet Gynecol 2010;35(1):75–83.
[21] Epstein E, Ramirez A, Skoog L, Valentin L. Transvaginal sonography, saline contrast sonohysterography and hysteroscopy for the investigation of women with postmenopausal bleeding and endometrium > 5 mm. Ultrasound Obstet Gynecol 2001;18(2):157–62.
[22] Yazicioglu F, Gökdogan A, Kelekci S, Aygün M, Savan K. Incomplete healing of the uterine incision after caesarean section: Is it preventable? Eur J Obstet Gynecol Reprod Biol 2006;124(1):32–6.
[23] Regnard C, Nosbusch M, Fellemans C, Benali N, van Rysselberghe M, Barlow P, et al. Cesarean section scar evaluation by saline contrast sonohysterography. Ultrasound Obstet Gynecol 2004;23(3):289–92.
[24] Dicle O, Küçükler C, Pirnar T, Erata Y, Posaci C. Magnetic resonance imaging evaluation of incision healing after cesarean sections. Eur Radiol 1997;7(1):31–4.
[25] Hamar BD, Saber SB, Cackovic M, Magloire LK, Pettker CM, Abdel-Razeq SS, et al. Ultrasound evaluation of the uterine scar after cesarean delivery: a randomized controlled trial of one- and two-layer closure. Obstet Gynecol 2007;110(4):808–13.
[26] Glavind J, Madsen LD, Uldbjerg N, Dueholm M. Ultrasound evaluation of Cesarean scar after single- and double-layer uterotomy closure: a cohort study. Ultrasound Obstet Gynecol 2013;42(2):207–12.
[27] Dodd JM, Anderson ER, Gates S. Surgical techniques for uterine incision and uterine closure at the time of caesarean section. Cochrane Database Syst Rev 2008;3:CD004732.
[28] Vikhareva Osser O, Valentin L. Clinical importance of appearance of cesarean hysterotomy scar at transvaginal ultrasonography in nonpregnant women. Obstet Gynecol 2011;117(3):525–32.
[29] Roberge S, Chaillet N, Boutin A, Moore L, Jastrow N, Brassard N, et al. Single- versus double-layer closure of the hysterotomy incision during cesarean delivery and risk of uterine rupture. Int J Gynecol Obstet 2011;115(1):5–10.