

UNIVERSITY *of* WASHINGTON

Perioperative Management of the Obese Parturient

Obstetric Consensus Conference

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March 2018



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CITATION

Walker C, Delaney S, Chandrasekaran, S. Perioperative Management of the Obese Parturient. University of Washington Obstetric Consensus Conference, March 2018.

Available at <http://providerresource.uwmedicine.org/women-s-health>

INTRODUCTION

Obesity (BMI $\geq 30\text{kg/m}^2$) is a growing epidemic on the rise in the United States, currently affecting around 1/3 of the population. The National Vital Statistics Report for 2016 using birth certificate data from 2014 demonstrated 50.4% of women who gave birth were overweight or obese [1]. Obesity increases antenatal complications and peripartum morbidity. Among pregnant women who undergo cesarean delivery, maternal obesity increases both intra- and post-operative complications including increased operative times, higher amount of blood loss, prolonged length of stay as well as increased post-operative wound complications [2], posing additional challenges for obstetric providers. Due to these increased risks, maternal class III obesity (BMI $\geq 40\text{kg/m}^2$) is often a reason for transfer to a tertiary center.

The purpose of this consensus statement is to provide perioperative guidelines that need to be considered when performing a cesarean section in an obese gravida. Three specific issues addressed include: 1) surgical skin incision placement for cesarean delivery, 2) prophylactic negative pressure therapy after cesarean delivery and 3) use of self-retaining retractors.

SKIN INCISION – DOES LOCATION MAKE A DIFFERENCE?

LITERATURE REVIEW

Currently most cesarean deliveries in the United States are completed through a Pfannenstiel incision. However, among obese patients, this incision could be suboptimal because: 1) accessing this region on the patient can be surgically challenging and 2) the incision is covered by the pannus, creating an anaerobic environment that is difficult for accessing, cleaning and keeping dry, thus increasing the risk of postoperative skin infections. We proceeded to analyze the existing data regarding alternate possibilities for skin incisions.

A secondary analysis of the Maternal Fetal Medicine Units Network (MFMU) cesarean registry including 3200 women undergoing a primary cesarean delivery with class III Obesity (BMI $\geq 40\text{kg/m}^2$) compared outcomes among women who had a vertical skin incision to those who had a Pfannenstiel skin incision. [3] Unadjusted analysis demonstrated higher wound complication rates among those with a vertical incision (1.7% vs 4.2%, $P<0.001$). Adjusted analyses, after controlling for confounders including maternal BMI, prophylactic antibiotic use and emergent cesarean delivery demonstrated that ***a vertical skin incision was associated with a lower risk of developing wound complications compared to a Pfannenstiel incision (Adjusted Odds Ratio (aOR) 0.32, 95% CI 0.17-0.62, $p=0.004$).***

The Pregnancy, Infection and Nutrition Study, an observational study of 5169 pregnant women, examined the effects of infection, stress, physical activity and nutrition on preterm birth. A secondary analysis of this cohort was conducted evaluating the association between type of skin incision and partial or complete wound separation. Wound separation was defined using 674 ICD-9 codes. Two hundred thirty eight women with BMI $\geq 29\text{kg/m}^2$ were evaluated in regards to wound complications. The majority of patients (89%) had a transverse skin incision, with 11% having a vertical skin incision. The overall incidence of wound complications was 13%. After controlling for confounders, higher BMI was associated with wound separation, $P<0.001$. However, ***type of skin incision was not associated with wound separation (aOR 2.8, $P=0.11$).*** [4]

Houston and Raynor conducted a retrospective study of women undergoing cesarean delivery with ideal body weight > 150% with either supraumbilical vertical (N=15) or Pfannenstiel (N=54) skin incision. [5] Mean maternal weight was higher among the group with a vertical incision (329 ± 60 pounds vs 246 ± 34 pounds, $P < 0.001$). **The odds of experiencing a wound complication was similar between the two groups (OR 0.98, 95% CI 0.18-4.74).**

Limited data exists regarding surgical outcome results from high transverse skin incisions compared to Pfannenstiel incisions. Preliminary data from a case-control study of women with class III Obesity undergoing a high transverse incision had a higher BMI compared to those undergoing a low transverse incision (49 kg/m² vs 42 kg/m²). [6] **They found lower, but non-significant difference in rates of wound complications in the high transverse group (10.5% vs 17.5%, $P = 0.72$).** A second retrospective cohort study included subjects undergoing cesarean delivery with either a high or low transverse skin incision [7]. The high transverse group had a higher BMI (41 kg/m² vs 45 kg/m²) and gestational diabetes rates (32.5% vs 19.2%) compared to the low transverse group. They found **no difference in wound complications.**

RECOMMENDATIONS

Given limited data and significant variation in results evaluating the association between skin incision and wound morbidities among obese women undergoing cesarean delivery, we recommend using the skin incision that maximizes visualization and ease of delivery based on maternal body habitus, prior surgical history and surgeon expertise. Women who may benefit most from a non-Pfannenstiel incision have a larger pannus regardless of BMI, multiple prior Pfannenstiel incisions or other pelvic surgeries.

PROPHYLACTIC NEGATIVE PRESSURE THERAPY – WHO BENEFITS THE MOST?

LITERATURE REVIEW

Literature from trauma, cardiothoracic, orthopedic, abdominal and vascular surgery has shown benefits of prophylactic use of negative pressure wound therapy (NPWT). **The incidence of wound infection and postoperative complications is decreased with the prophylactic NPWT following primary skin closure in general surgery literature.** [8, 9] Maximum benefit was noted in clean-contaminated cases, particularly after bowel and trauma surgery. Studies have attempted to show this same effect following cesarean delivery with limited success.

A randomized control feasibility trial was conducted from May 2014 to March 2016 at a tertiary referral center including all women who had recorded BMI ≥ 30 kg/m² prior to 22 weeks gestation. [10] They were then recruited and consented during labor and randomized after decision for cesarean was made to either NPWT (Prevena™) or standard surgical dressing. All incisions were closed with staples. A total of 69 women were randomized to standard dressing and 67 to NPWT, 14 subjects were lost to follow up. There were no significant differences in baseline or surgical characteristics between the groups. Primary outcome was composite wound complication, wound infection or need to reopen and pack the wound. Secondary outcomes included skin breakdown/blisters, increased post-operative pain, increased length of stay or patient concerns regarding healing at the 2 week post-operative visit. **There were no differences between the groups in terms of primary or secondary outcomes. The overall wound complication rate was 5.9%. As this was a feasibility study, they concluded that more than 15,000 subjects need to be recruited to effectively assess the impact of NPWT.**

A retrospective cohort study was conducted at an institution that implemented a protocol standardizing the use of NPWT. Rates of wound complications based on ICD-9 codes were compared among women with BMI ≥ 45 kg/m² undergoing CD prior to the protocol implementation and after the protocol implementation.[11] Prior to NPWT use, 48 subjects were included, and following implementation 62 women met criteria for NPWT, but only 21 received it and were included in the study. Significant differences existed among the NPWT group and control group for unscheduled cesarean sections (47.6% vs 22.9%, $p=0.04$), length of labor (260.9 ± 376.9 mins vs 77.7 ± 239.6 mins, $p=0.02$) and use of subcuticular suture for skin closure (95.2% vs 14.6%, $p<0.001$). Despite these differences, which are known risk factors for surgical site infections, **there was no statically significant difference in wound complications between groups (10.4% vs 0.0%, $P=0.15$).** Interestingly, all complications occurred in the control group, suggesting some clinical benefit to NPWT in this population and statistical significance may not have been proven due to small number of complications and subjects per group.

A retrospective cohort study at the University hospital in Dublin, Ireland, reported outcomes of obese women (N=26) who underwent cesarean delivery and subsequent placement of a negative pressure wound therapy device (Prevena™). [12] Prevena™ was placed on all women with a BMI ≥ 30 kg/m² and wound complications were reported. There was no control group in this study. Median BMI was 45.3kg/m², and 77% of deliveries were elective, non-labored cesarean deliveries. Superficial dehiscence occurred in 15% of patients and 27% of women were diagnosed with a wound infection. **Infection ($p=0.03$), increasing BMI ($p<0.001$) and emergency cesarean delivery ($p=0.04$) were associated with wound breakdown. There was no association between BMI >50 kg/m² or diabetes and the risk of wound breakdown.**

A retrospective study at a single institution reviewed all cesarean deliveries during a 2-year period (N=970) and compared outcomes between NPWT (N=103) with no NPWT (N=863). [13] The group receiving NPWT had higher rates of pre-gestational DM (18% vs 3%, $p<0.001$) and preeclampsia (30% vs 11%, $p<0.001$), higher BMI (43.3 ± 9 kg/m² vs 32.4 ± 6 kg/m², $p<0.001$) and earlier delivery (36.2 ± 5 weeks vs 37.6 ± 4 weeks, $p=0.001$). Initial analysis showed increase in wound separation with use of NPWT (OR 3.27, $P=0.001$). **After multivariate analysis there was no difference in wound complications (OR 1.45, 95% CI 0.6-3.48, $P=0.41$).**

Most recently, a systematic review and meta-analysis of six randomized controlled trials and three cohort studies predominantly enrolling obese women was performed [14]. **In evaluating the primary outcome of a surgical site infection, results demonstrated a significantly lower risk of developing an infection with the use of NPWT (pooled risk ratio 0.45, 95% CI 0.31-0.66, adjusted risk ratio -6.0%, 95% CI -10%- -3%) with no evidence of publication bias (Egger $p=0.532$).**

A cost benefit analyses utilizing a baseline cost of \$804 for NPWT therapy demonstrated **cost effectiveness when used in a high-risk population, which was defined as those having a baseline risk of infection of 14%, or the ability to decrease infection rate by 15% with use.** [15]

RECOMMENDATIONS

While individual studies in obstetric literature have not shown a statistically significant benefit in utilizing NPWT, the most recent meta-analysis by Yu et al strongly suggests an overall decrease in wound infection rates. Therefore, given the benefit seen in other surgical fields, the lack of any obstetric study to show harm, and a potential meta-analysis suggesting benefit, we support the use of prophylactic NPWT in high risk patient populations including BMI ≥ 40 kg/m² and pre-gestational diabetes. NPWT use should be strongly considered for patients with other risk factors for wound infection. Risk factors for wound infection include large pannus with BMI < 40 , history of wound complications, smoker, preeclampsia or other vascular disease.

SELF-RETAINING RETRACTORS – TO USE OR NOT?

LITERATURE REVIEW

Self-retaining retractors are helpful to improve visualization of the surgical field, decrease bowel manipulation and decrease instrumentation of the incision during a case. In the general surgery literature, use of self-retaining retractors is associated with decreased postoperative wound infection. Studies have examined if this same relationship holds true to obstetric cases.

A randomized controlled trial analyzing the effects of the Alexis® O self-retaining retractor use on surgical site infection and wound disruption rates was performed among women undergoing non-emergent cesarean delivery. The primary outcome for this study was the incidence of surgical site infections by the CDC criteria. Secondary outcomes included total surgical time, time from incision to delivery, estimated blood loss, change in hemoglobin, blood transfusion, antiemetic use, uterine exteriorization, length of hospital stay, emergency room visit for wound complications, as well as multiple neonatal outcomes. There were 157 subjects in control group and 144 in the self-retaining retractor group. There were no baseline characteristic differences between the groups. **No differences were found between groups for the primary outcome (20.6% vs 17.6%, $P= 0.62$), and among secondary outcomes a lower rate of uterine exteriorization in the Alexis O group was noted (54.3% vs 87.3%, $P< 0.001$).**[16]

Another randomized control trial was conducted to examine the impact of the Alexis® O plastic self-retaining retractor on surgical site infection in low risk women undergoing primary, scheduled, non-laboring cesarean delivery. [17] Women were randomized to standard stainless-steel retractor (N=100) versus plastic sheath retractor (N=98). The primary outcome was surgical site infection, and secondary outcomes included patient satisfaction with incision and postoperative pain as well as surgeon preference with retractor use. **Plastic sheath retractor was found to have higher patient and surgeon satisfaction survey scores for all parameters ($P < 0.001$) and less postoperative narcotic use (19% vs 43%, $P < 0.001$). A decrease in postoperative surgical site infections was seen with the number needed to treat (NNT) 14 (RR 7.84, $P=0.035$).**

Unpublished data presented at the American College of Obstetricians and Gynecologists Annual Meeting in May 2016 by Anquandah et al, reported a retrospective cohort study of 134 obese women evaluating whether use of an Alexis® O self-retaining retractor shortened the time between skin incision to hysterotomy.[18] Group A = 54 women with a BMI of 30-50kg/m² where an Alexis® O was used; Group B = 60 women with a BMI of ≥ 50 kg/m² where an Alexis® O was used; Group C = 20 women with BMI ≥ 50 kg/m² on whom an Alexis® O was not used. Skin incision to hysterotomy times averaged 13, 11 and 15 minutes in groups A, B and C, respectively. The authors proposed a **potential decreased time from skin incision to hysterotomy with Alexis® O use in obese women.** Publication of this poster presentation is pending at the time of this consensus review.

A 2017 randomized control trial compared the use of a Mobius® self-retaining retractor to conventional retractors during cesarean delivery for 144 women.[19] BMI at the time of delivery for the Mobius® group was 35 kg/m² and 34 kg/m² for the conventional group. The primary outcome was patient experience of postoperative pain, with secondary outcomes including physician experience, operative times and estimated blood loss. Analysis demonstrated **no significant differences in pain scores for women having a Mobius® versus conventional retractor. Pain medication use was also similar between study groups.** On physician survey regarding ease of

retraction use, 91% of physicians using the Mobius reported easy use, compared to 84% using conventional retractors, however this was not statistically significant (P=0.57). **Operative times and estimated blood loss were similar between groups** (67.2 minutes and 894mL for Mobius® versus 61.0 minutes and 894mL for conventional retractor, P = 0.32 and P=0.99, respectively).

RECOMMENDATIONS

After review of these studies we suggest use of self-retaining retractors based on surgeon preference. Cases that may benefit from improved visualization are obese women, particularly those with increased depth of subcutaneous tissue, preterm uterus with prolapsing bowel or any case when deemed to be beneficial for visualization. As use of self-retaining retractor is most useful when uterus is not exteriorized; use for planned tubal ligation may not be ideal.

DISCUSSION

Obesity is associated with increased surgical difficulty and increased postoperative complications, thus highlighting the need for specific protocols to improve surgical outcomes with a focus on intra-operative care and postoperative infection. After review of the available limited obstetric data, recommendations were made to facilitate a well thought out surgical plan prior to delivery, addressing both surgical techniques as well as postoperative care. Surgical skin incision location should be determined after physical exam of maternal body habitus while in supine position. Discussion of self-retaining retractor should be considered given her prior surgical history, need to exteriorize the uterus, plan for tubal ligation, and location of skin incision in relation to maternal pannus. Prophylactic NPWT should be also be considered for postoperative care based on maternal body habitus, BMI and risk of postoperative infection.

SUMMARY RECOMMENDATIONS

SKIN INCISION PLACEMENT

The use of non-Pfannenstiel incisions should be considered in patients with BMI ≥ 40 , to avoid placement of surgical incision under the pannus that limits postoperative cleaning and assessment by the patient. Placement of vertical or high transverse incisions should be determined based on maternal body habitus, prior surgical history and surgeon expertise.

PROPHYLACTIC NEGATIVE PRESSURE THERAPY

We support use of prophylactic NPWT for patients with BMI ≥ 40 and in pre-gestational diabetics. Use can also be considered in patients who have a BMI < 40 when one or more risk factors for post-operative infection are present including but not limited to: body habitus with large pannus, history of prior surgical site infection or wound healing complications, smoker, diabetic, preeclampsia, or other vascular disease that increases baseline risk for wound complications.

SELF-RETAINING RETRACTORS

Use should be considered for all cases with obese patients and may prove beneficial to improve visualization and decrease postoperative pain in patients with large pannus, preterm gestation, difficult visualization due to prolapsing bowel, or deep subcutaneous tissue.

PRACTICE IMPLICATIONS

1. Non-Pfannenstiel skin incisions should be considered when, due to maternal body habitus, a Pfannenstiel incision would be placed under the pannus. Either midline vertical or high transverse may be used based on surgeon assessment at time of cesarean delivery.
2. Negative pressure wound therapy should be placed at the time of cesarean for patients with BMI ≥ 40 or who have pre-gestational diabetics.
3. Placement of negative pressure wound therapy should be considered in patients with a BMI of < 40 with additional risk factors for wound complications (large pannus, history of wound complications, smoker, preeclampsia or other vascular disease).
4. Self-retaining, plastic sheath retractors (such as Alexis® O) should be considered in any case that needs additional visualization.

DISCLAIMER

This consensus document is to be used as a guideline for practice management. It is generated by expert review from the UW Departments of Obstetrics & Gynecology. If clinical judgment by providers involves deviation from these recommendations, then appropriate documentation regarding that decision-making should be available in the patient chart.

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