

Retrospective Review of Wound Complications Following Skin Closure by Either Percutaneous Metal Staples or Absorbable Subcuticular Staples in Patients Undergoing Cesarean Delivery

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Abstract

Objective: To determine the wound complication rate of patients undergoing cesarean delivery skin closure by either percutaneous metal staples or absorbable subcuticular staples in a large teaching hospital.

Methods: This was a retrospective chart review of six hundred sixty patients who underwent cesarean delivery skin closure with either metal staples or absorbable staples. The primary outcome examined was the development of any wound complications.

Results: Two hundred forty eight patients were eligible for analysis in the metal staple group compared to sixty-five patients in the absorbable staple group. A 7.7% wound complication rate was observed in the absorbable staple group compared to a 21.3% wound complication rate in the metal staple group. A statistical difference ($p=0.01$) was noted between the two groups. Body mass index between both groups were also statically different yielding 37 kg/m^2 in the metal staple arm group versus 32 kg/m^2 ($p \leq 0.001$) in the absorbable staple group.

Conclusion: Percutaneous metal staples were associated with more wound complications compared to absorbable subcuticular staples. Body mass index was greater in the percutaneous metal staple group as compared to the absorbable subcuticular staple group.

Keywords: Cesarean delivery; Metal staples; Absorbable staples; Surgical site infection; Wound complication

Background

Cesarean delivery has become one of the most commonly performed surgical procedures in the United States [1]. Surgical complications such as wound breakdown or infections following cesarean deliveries are increasingly common. The presence of specific co-morbidities such as chronic hypertension, diabetes, and history of tobacco use, are known risk factors associated with post-operative wound complications [2]. Other risk factors such as depth of incision, obesity, duration of surgery, surgeon skill level and estimated blood loss, have all been proposed to lead to post-operative infection, but the role that these play in wound complication is less clear [2]. Currently, there are several options that surgeons may use for cesarean delivery skin closure. These include absorbable subcuticular suture, percutaneous metal staples with later removal, absorbable subcuticular staples (Inisorb® Incisive Surgical, Plymouth, MN) composed of a polylactic/polyglycolic co-polymer, or closure with a non-absorbable suture with removal of this suture at a post-operative visit. There are few studies detailing the incidence of wound breakdown or infection associated with methods of skin closure. Of the available studies, each found a higher rate of wound infection after closure with percutaneous metal staples versus 4-0 Monocryl subcuticular suture [3,4].

Wound complications can place an extensive economic burden on patients, hospitals, and the United States health care system. Readmissions to hospitals for postoperative wound complication care often involve the assistance of ancillary services such as home health management and vacuum assisted closure of wounds [5]. These all can cause an emotional and financial burden for the patient after delivery of her newborn.

The purpose of this study was to determine if using absorbable subcuticular staples versus percutaneous metal staples imposes an increased risk of wound breakdown, infection, or other wound complications. The primary objective of this study was to evaluate the overall incidence of wound complications between patients who either

had absorbable subcuticular staples or percutaneous metal staples for skin closure at the time of cesarean delivery. In addition, we evaluated the contribution of patient's pre-existing co-morbidities in relationship to wound complication outcomes.

Methods

This retrospective chart review evaluated cesarean deliveries that occurred from January 1, 2010 until January 31, 2011 at Memorial Hermann Hospital in the Texas Medical Center. Institutional Review board approval was obtained (HSC-GEN-11-0169) prior to data collection. Patients were identified using a computerized data list of all University of Texas-Houston obstetric patients who delivered during the specified time period. Patients were eligible for inclusion in our study if they were a University of Texas-Houston faculty or resident patient who underwent cesarean section and had skin closure with either absorbable subcuticular staples or percutaneous metal staples from January 1, 2010 - January 31, 2011. Patients of all ages, co-morbidities, and reasons for cesarean section were included. Patients that were excluded from the study were non University of Texas-Houston resident or faculty patients, patients that did not have either absorbable subcuticular staples or percutaneous metal staples at the time of skin closure, and any patient who was lost to follow up.

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Six hundred-sixty patients who fit the selection inclusion criteria were identified during the study period. Each patient's electronic medical chart was reviewed including history and physical, operative reports, discharge summaries, and anesthesia records. Wound assessment at follow up visits was also reviewed using the electronic medical record. Patient wound complications, demographics, and co-morbidities were compiled and recorded on a data sheet. Wound complications that were identified included wound infection, wound separation, seromas, hematomas, and cellulitis. Patients who had to be readmitted to the hospital secondary to a wound complication were also documented, as were any patients who required treatment in the operating room due to a wound complication. Assessment and identification of wound infections were counted as surgical site infections based on the CDC guidelines: Wound infections were defined as a surgical site with purulent drainage, dehiscence, positive wound culture, the patient experiencing fever (temp >100.4 degrees Fahrenheit), and/or diagnosis was confirmed by an attending [6]. Wound separations were defined as incisions that had been assessed and noted to have non-apposed skin edges. Wound cellulitis complications were defined as superficial skin inflammation around incision. Wounds were considered to be completely healed if no complications were encountered by the patient's six-week post-partum clinic visit.

Characteristics	Percutaneous Metal	Absorbable Subcuticular Staples	P value
BMI (Total)	37.2	32.7	0.0007
BMI (Complications)	42.5	42.4	0.987
OR Time min (Total)	61.3	53.9	0.033
OR Time min (Complications)	70.2	59	0.392
Age (Total)	27.5	27.6	0.940
Age (Complications)	27.8	26.2	0.605
Pre-Op Abx Given	245 (99%)	65 (100%)	1
IAI at Time of Surgery	7 (2.8%)	0 (0%)	0.351
Primary C/S	108 (43.5%)	30 (46%)	0.779
Repeat C/S	127 (51.2%)	35 (54%)	0.780
Tobacco use (total)	27 (10.9%)	6 (9.2%)	0.822
Tobacco use (Complications)	7 (13.2%)	2 (40%)	0.076

Table 1: Surgical Characteristics.

Maternal demographics were also collected including age, parity, race, ethnicity, surgical complications, reason for cesarean delivery, operative time, and use of intrapartum antibiotics. Co-morbidities that were examined included but were not limited to patients with diabetes mellitus, HIV, chronic hypertension, and tobacco usage. Body mass index of all patients was recorded.

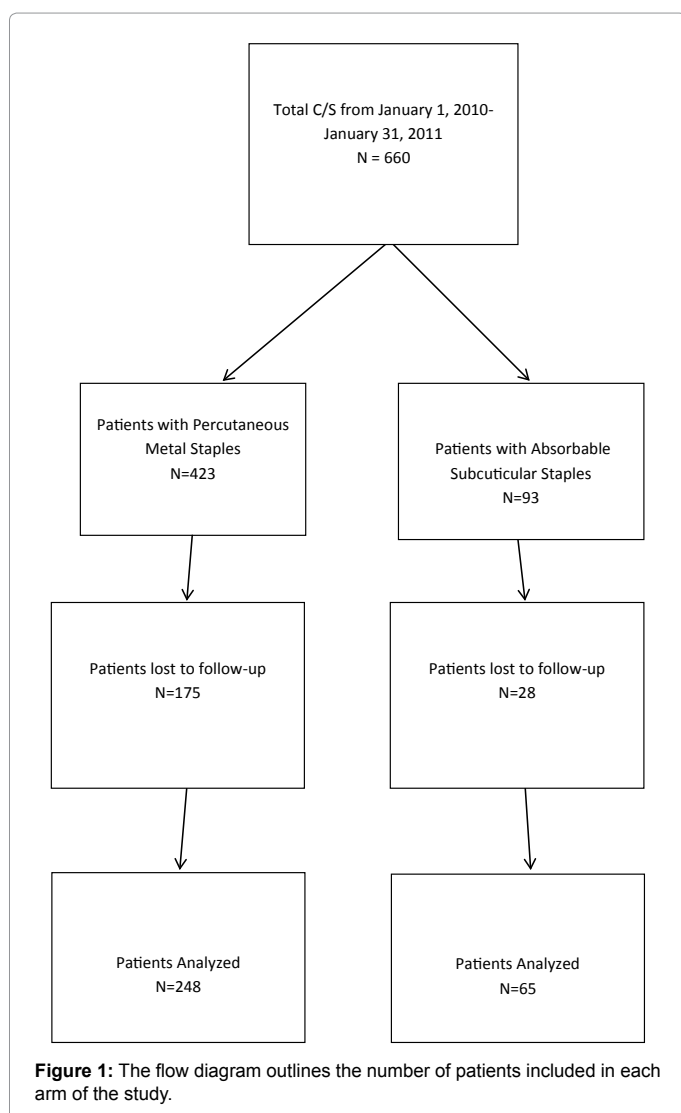
Data including wound complications and patient demographics were entered into a spreadsheet. The number and types of wound complications in the absorbable subcuticular staple group were compared to those in the percutaneous metal staple group. Data were then analyzed using appropriate Fisher exact and Student's t tests, as appropriate.

Results

Data analysis of 660 University of Texas-Houston patients revealed that 423 patients had percutaneous metal staples for cesarean delivery skin closure versus 93 patients who had absorbable subcuticular staples for their skin closure (the remaining 144 patients had skin closure performed with either an absorbable or non-absorbable suture). The flow diagram outlines the number of patients included in each arm of the study (Figure 1). Out of 423 patients with percutaneous metal staple skin closure, 175 patients were lost to follow up leaving 248 patients in the percutaneous metal staple group. Twenty-eight patients who had absorbable subcuticular staples at the time of skin closure were lost to follow up leaving a total of 65 patients in this group.

Review of surgical characteristics revealed no statistically significant differences between the metal staple group and the absorbable subcuticular group; except for BMI and total OR time (Table 1). The absorbable subcuticular staple group required significantly less time, and was placed in patients with lower BMI. In the absorbable staple group, 5 patients had wound complications yielding a 7.7% overall complication rate (Table 2). Two patients had wound separations, two patients were noted to have wound infections and one patient was diagnosed with a superficial wound cellulitis. Two patients required readmission to the hospital and take-back to the operating room for wound debridement (Table 2).

In the percutaneous metal staple skin closure group, fifty-three patients had wound complications for an overall complication rate of 21.3% (Table 2). Thirty-nine patients who had percutaneous metal staples for skin closure experienced wound separations and nine patients were documented to have wound infections. Other wound



Wound Complications	Percutaneous Metal (n =248)	Absorbable Subcuticular Staples (n = 65)	P value
Composite Wound	53 (21.3%)	5 (7.7%)	0.0114
Wound Separation	39 (15.7%)	2 (3.1%)	0.0062
Wound Infection	9 (3.6%)	2 (3.1%)	1
Cellulitis	10 (4.0%)	1 (1.5%)	0.4701
Seroma/Hematoma	10 (1.2%)	0 (0%)	0.1295
Readmission	21 (8.5%)	2 (3.1%)	0.1843

Table 2: Wound complications.

Characteristic	Percutaneous metal	Absorbable Subcuticular Staples	P value
Diabetes Mellitus	39/248 (15.7%)	15/65 (23.1%)	0.2013
Hypertension	45/248 (18.1%)	9/65 (13.8)	0.4663
Systemic Lupus Erythematosus	4/248 (1.6%)	2/65 (3.1%)	0.1917
Hypothyroidism	8/248 (3.2%)	4/65 (6.2%)	1
Asthma	21/248 (8.5%)	5/65 (8.5%)	1

Table 3: Maternal Co-Morbid Conditions (Total).

complications noted in percutaneous metal staple study arm group included wound cellulitis and seroma formation.

The overall complication rate of absorbable subcuticular staples (7.7%) was compared to that of percutaneous metal staple cesarean skin closure (21.3%) using Fisher's exact test and a statistically significant difference ($p=0.01$) was noted, supporting a lower overall complication rate in the subcuticular staple group. The prominent complication in the metal staple group was wound separations (15.7%) compared to a lower rate (3.1%) for absorbable subcuticular staples. The readmission rate in the metal staple group was (8.5%) compared to (3.1%) for absorbable subcuticular staples. The mean BMI in the percutaneous metal staple group was 37kg/m^2 compared to 32kg/m^2 in the subcuticular staple group with a statistically significant difference ($p<0.001$). There was not any statistically significant difference in BMI between both groups in relation to wound complications. Additional maternal baseline characteristics are displayed in the final table (Table 3).

Discussion

There have been few studies comparing wound complication rates between different methods of cesarean skin closure. Most studies have compared absorbable suture to percutaneous metal staples. One study in particular found that incisions closed with percutaneous metal staples had an increased rate of wound separation compared to absorbable suture [2]. This study was repeated more recently, and similar results were obtained [7]. Both studies were underpowered to detect the primary outcome, however: The former study underwent an interim analysis prior to enrolling the 874 subjects determined to be necessary before the study was initiated, and the latter study halted enrollment after substituting a higher rate of wound complication, but was still underpowered even with this supposed increase in the rate of wound complications [3,7]. Our study shows an increased rate of wound complications in those who received percutaneous metal staples at the time of skin closure compared to absorbable subcuticular staples. Although there was a significant difference in wound complications exhibited between women who had percutaneous metal staples versus absorbable subcuticular staples in our study, body mass index differed significantly between both groups, supporting obesity as a known risk factor for wound complications.

While our study had many strengths, including the evaluation of subjects from a large patient population with diverse maternal co-

morbid conditions, there were many limitations in this study. These limitations included possible surgeon selection bias, and a large number of patients were lost to follow up. In regards to the latter limitation, it should be noted that a large number of patients were lost to follow up in both study arms, and that loss of patients to follow up is not an uncommon phenomenon in tracking post-operative wound complications [8]. Surgeon selection bias may have been introduced into our study as seen in the differences in body mass index values between both study groups. We hypothesize that some surgeons may have chosen absorbable subcuticular staples as a means of closure for less obese patients and elected to use percutaneous metal staples for the more obese patients. The rate of wound complications could also be confounded by maternal co-morbid conditions that may predispose for wound complications. Because of our study's retrospective nature, we could not fully control for this.

The method of skin closure at the time of cesarean delivery is an important decision that can impact the risk of wound complications, patient satisfaction, and the economic burden on patients and hospitals. Based on our study's results, percutaneous metal staple closure were utilized more often in larger patients: however, one may consider using absorbable subcuticular staples given the decrease in surgical time as well as lower incidence of post-operative wound complication when compared with percutaneous metal staples. Future studies should include a larger sample size and randomized controlled allocation to assess wound complications rates and to control for patient confounding co-morbid conditions such as BMI.

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