

## ARTICLE

# Incisional Hernia of Elective Midline Caesarean Section: Incidence and Risk Factors

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Published: 01 November 2011

Ibnosina J Med BS 2011,3(6):205-210

Received: 31 January 2011

Accepted: 14 March 2011

This article is available from: <http://www.ijmbs.org>

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## Abstract

The precise incidence of incisional hernia after midline cesarean section is unknown. The aim of this study was to analyze the incidence and risk factors for hernia after elective lower midline caesarean section (CS). A prospective cohort study of 284 women for incisional hernia development after elective midline CS) was conducted at Prince Hashem Ben Al-Hussein hospital from April 2006 to December 2008. All patients included had a history of at least two previous CSs. Patients were divided in two groups: one study group consisted of women who had an incisional hernia and the control group consisted of women who had not developed an incisional hernia within two years post CS. Within the two groups, potential risk factors (age, body mass index, parity, number of previous cesareans, type of previous incision, chronic cough, diabetes mellitus, heart disease, low albumin, anesthesia type, postoperative fever and wound complications) were statistically analyzed with the development of incisional hernia. The two year

hernia frequency was 5.6 %.Independent risk factors of incisional hernia development included: increase in number of previous CSs, obesity, and wound complications. We concluded that this incidence was higher than previously estimated. Counseling on the family size for this group of women will reduce the chance for further CS with its associated risk. In addition, measures to reduce wound infections may reduce the incidence of incisional hernia following elective midline cesarean section.

**Key words:** Women, Cesarean section, hernia, wound, complications.

## Introduction

The accurate incidence of incisional hernia (IH) after midline cesarean section is unknown. Incidence of 1.3-5.4 % have been reported (1-4). Over half of incisional hernias are diagnosed within the first year after surgery, and approximately 80% are diagnosed within the first 3 years

(5). The rate of repeated cesarean section has increased gradually in all parts of the world (6,7) as it became more acceptable and safe. In the United States, more than one-fifth of all births are by caesarean section and about one-third of all caesareans are an elective repeat operation (8, 9). A variety of factors have been implicated in wound failure, including obesity and wound infection, early wound dehiscence, surgical technique, immunosuppressant therapy, anaemia, diabetes mellitus, malnutrition, jaundice, and azotaemia (10-14). The simplest theoretical scenario of hernia development is that a traumatized tissue loses a portion of its structural integrity, allowing protrusion of an organ or viscera into a region that is not its normal location (15). Recurrent trauma of tissues with repeated cesarean sections would cause further weakness of abdominal wall, making this tissue consecutively prone to hernia formation. Review of the literature on caesarean section in Jordan revealed inadequate recognition of this late consequence despite the increasing rate of caesarean section (16). We have therefore wished to evaluate the incidence and the risk factors of IH in patients undergoing elective lower midline caesarean section (EIMCS).

## Methods

### Clinical trial design

A prospective cohort study conducted at Prince Hashem Ben Al-Hussein hospital (Zarqa, Jordan). Study participants were recruited from pregnant women who were admitted and required an elective midline CS (ELMC) due to previous (two or more) CSs. All CSs were performed between April 13, 2006, and December 12, 2008. Informed (written) consent from all participants was obtained.

### Eligibility criteria

All procedures were performed by senior physicians in our unit. This included fascia closure (with #1 Loop PDS) in a mass closure fashion with the goal of a 4:1 suture length to wound length ratio. Reasons for exclusion from the study include the following:

1. A cesarean section by a Pfannenstiel incision
2. Use of subcutaneous drains
3. Incomplete data
4. Difficult to contact (phone or appointment to the clinic)
5. Immune deficiency, connective tissue disorders, or any medical illness requiring immunosuppressive therapy
6. Previous anterior abdominal wall incisional hernia
7. Patients who withdrew from the study for any

reason before the end of the required 2- year follow-up

8. Patients who became pregnant during the follow up period

### Study interventions

Study participants were scheduled for ELMCS before study enrollment. All patients received prophylactic antibiotics. Use of prophylactic antibiotics is our unit policy (single dose of ampicillin or first-generation cephalosporin after cord clamping). Demographic, medical history, laboratory, perioperative, operative, and surgical outcomes data collected prospectively over a minimum follow up period of two years postoperatively. Demographic variables included age, body mass index (BMI) and parity. Medical history data included number of previous CS and type of this scar (Pfannenstiel or midline), diabetes mellitus, gestational diabetes, heart disease, history of chronic cough, history of smoking. Laboratory data recorded at time of study entry included preoperative albumin level. Perioperative data included type of anesthesia (general or spinal), operative time (minutes from time of laparotomy incision to closure) and intraoperative or postoperative blood transfusion, fever and local wound complications (cellulitis, seroma, infection, hematoma and dehiscence). The primary outcomes variable was the presence of incisional hernia (palpable incisional fascial defect  $\geq 2$  cm in diameter, or visible bulge in the laparotomy incision) within two years of operation.

### Follow-up

All study subjects were followed up for a minimum of two years for development of incisional hernia. Patients asked to attend our clinic every six months or at any time if there was development of a problem from the scar. The primary ends of this study were development and time to development of incisional hernia. Incisional hernias diagnosed either by imaging (CT scan) or by physical exam. Medical records, including operative reports, radiologic images and reports, and laboratory results reviewed and data were extracted. We calculated the rate of hernia development within two years of the procedure.

### Statistical methods

Categorical data presented as number (n) with percentage (percentage). Continuous and ordinal data presented as means with standard deviations (Mean  $\pm$  SD). Significance was determined at the  $p < 0.05$  level (2-tailed). We use a set of preoperative and operative risk factors as independent variables and development of incisional hernia as a

dependent variable. The variables documented for each case included: age, body mass index (BMI), parity, number of previous cesareans, smoking, history of chronic cough, diabetes mellitus (DM), gestational diabetes (GD), heart disease, albumin level, type of anesthesia (general or spinal), previous CS incision (Pfannenstiel vs. midline),

perioperative blood transfusion, and local wound complications (cellulitis, seroma, infection, hematoma and dehiscence).

Each factor found to be significant on univariate analysis was included in the multivariate model. Multivariate analysis was performed with binary logistic regression.

Table 1. Demographic and Clinical data characteristics of the 284 women included in the study. Data are presented as mean  $\pm$  standard deviation (range) or number (percentage):

Characteristics	Details
Age (years)	33.3 $\pm$ 6.5 (23-28)
Body mass index (kg/m <sup>2</sup> )	26.4 $\pm$ 3.3 (18-33)
Parity	3.6 $\pm$ 1.5 (2-11)
Number of Previous Caesarean Sections	3.2 $\pm$ 1.2 (2-6)
<b>Smoking Status:</b>	
non smoker	196 (69%)
light smoker	53 (18.7%)
smoker	35 (12, 3%)
<b>Past and Current Medical History:</b>	
Bronchial Asthma:	39 (13.7%)
Diabetes Mellitus:	19 (6.7%)
Gestational Diabetes:	36 (12.7%)
Heart Disease:	23 (8.1%)
Preoperative Plasma Albumin Level (mg/dl):	2.6 $\pm$ 0.5
<b>Type of anesthesia and perioperative details:</b>	
General anesthesia	212 (74.6%)
Spinal anesthesia	72 (25.4%)
Operative time (minutes)	55.2 $\pm$ 16.5 (35-120)
Patients Needing Blood transfusion	19 (6.7%)
Postoperative Fever	29 (10.2%)
<b>Wound complications:</b>	
Superficial infection	14 (4.9%)
Hematoma	12 (4.2%)
Seroma	7 (2.5%)
Wound dehiscence	2 (0.7%)

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 17.0 (SPSS Inc, Chicago, Illinois).

## Results

Of the three hundred and nineteen patients, 13 (4%) were excluded because of incomplete follow-up within two years postoperatively, eight (2.5%) because of incomplete data, and 14 (4.3%) because they became pregnant within two

**Table 2.** Comparison of demographic and clinical data characteristics of the women who developed incisional hernia versus no hernia.

Data are presented as mean±standard deviation (range) or number (percentage).

Variables	Incisional hernia group(n=16)	No incisional hernia group(n=268)	Univariate analyses P value	Multivariate analyses P value
Age (years)	32 ± 4.9	33.3 ± 6.6	0.43	0.08
Body mass index (kg/m <sup>2</sup> )	29.6 ± 2.7	26.2 ± 3.2	<0.0001	<0.0001
Parity:	4.6 ± 1.4	3.6± 1.8	0.049	0.18
Number of Previous Caesarean Sections:	4.2 ± 1.3	3.1 ± 1.2	0.006	<0.0001
<b>Type of Previous Scar:</b>				
Pfannenstiel	4 (25%)	106 (39.7%)	0.24	0.31
Midline	12 (75%)	161 (60.3%)	0.24	
<b>Smoking Habit:</b>				
Non smoker	10 (62.5%)	193 (72%)	0.65	0.49
Infrequent smoker	4 (25%)	43 (16%)	0.06	
Regular smoker	2 (12.5%)	32 (12%)	.07	
<b>Past and Present Medical History:</b>				
Chronic cough	5 (31.3%)	34 (12.7%)	0.04	0.58
Gestational Diabetes	3 (18.8%)	16 (6%)	0.13	0.71
Diabetes Mellitus	5 (12.5%)	8 (3.2%)	0.048	0.82
Heart disease	2 (12.5%)	21 (7.8%)	0.51	0.93
<b>Anesthesia and Perioperative Details:</b>				
General	11 (68.7%)	201 (75%)	0.58	0.69
Spinal	5 (31.3%)	67 (25%)		
Operative Time	64.2 ± 20.8	63.7 ± 21.6	0.89	0.47
Blood Transfusion	2 (12.5%)	17 (6.3%)	0.39	0.17
Level of albumin	2.5± 0.36	2.6 ± 0.46	0.12	0.35
Presence of fever	3 (18.8%)	26 (9.7%)	0.25	0.49
<b>Wound Complications:</b>				
Cellulitis	3 (18.8%)	11 (13.5%)	0.21	0.002
Hematoma	2 (12.5%)	10 (11.3%)	0.89	
Seroma	3 (18.8%)	6 (8.5%)	<0.0001	
Wound dehiscence	0	2 (0.7%)		

years of operation. Therefore, 284 patients were included in the study. Their demographic, obstetric, medical characteristics together with the anesthetic data and wound complications are summarized in **Table 1**. With a mean follow-up time for the study population  $20.6 \pm 3.3$  months, a total of 16 (5.6%) women developed incisional hernia and 268 (94.4%) did not develop incisional hernia, three cases (12.5%) of IH were asymptomatic.

The two groups (those who developed IH versus those who did not develop IH) were compared (**Table 2**). Six factors were found to be of significant importance within the group who developed IH by univariate analysis: number of previous CSs ( $p < .0001$ ), BMI ( $p < .0001$ ), parity ( $p = .05$ ), DM ( $p = .05$ ), chronic cough ( $p = .04$ ) and wound infection ( $p = .003$ ). However, on multivariate analysis, three factors of six factors mention above remain significant: CSs ( $p < .001$ ), BMI ( $p < .001$ ), and wound infection ( $p = .002$ ). Other factors (age, previous incisional scar, gestational diabetes, preoperative low albumin level, and type of anesthesia, duration of operation, perioperative blood transfusion and postoperative fever) were not significant (**Table 2**).

## Discussion

Ventral hernia, a well established complication of midline laparotomy, is defined as an acquired protrusion through the anterior abdominal wall fascia<sup>16</sup>. There is insufficient and conflicting reports on the frequency of incisional hernias in CS and, indeed, in ELMCS. Earlier studies showed rates of incisional hernia of 3.2% (1), 5.4% (2) and 5.2% (4) for midline CS. However, the incidence was slightly higher in our cohort study, noted to be 5.6 %. A possible explanation for this discrepancy is, that all women in our cohort study group had a history of two or more previous CSs.

In this study, several factors were evaluated to determine which one independently increases the likelihood of an incisional hernia post midline CS. In agreement with previous studies in this area (1, 4) our data revealed that the most important constant and independent factor is the repeated frequency of caesarean section (Table 2). With the increased occurrence of this operation, it expected to increase the likelihood of hernia formation.

Obesity and wound infection are apparently associated factors in surgery, and it generally accepted that morbidly obese patients have a higher risk of wound infection, which, in turn, leads to an increased incidence of incisional hernias.

However, there were conflicting reports about the role of wound infection as causative for IH, in particular long-term hernia formation. While there are studies that confirm this (18-20), others do not (21, 22). In this present study, we found that increased BMI and wound complication were independent risk factor for IH within the two-year cohort study (Table 2). This may be the result of impaired collagen synthesis at infected wound sites.

Previous studies recognized that the presence of diabetes mellitus is a risk factor of incisional hernia occurrence (21). Studies of this comorbidity flooded bias, lack of statistical capacity, and reporting issues. The best current evidence, however, does not suggest diabetes mellitus dramatically affect incisional hernia rate<sup>18</sup>. In our study, nearly half of diabetic patients developed hernia later, which is significant in comparison to non-diabetic patients.

Although this subgroup was too small to fully evaluate this association. There is disagreement about whether smoking influences the rate of incisional hernia. Some studies found that smoking influence the rate of IH (23, 24), while other researchers did not confirm this conclusion (18). Our study could not confirm that smoking considerably alters the rate of incisional hernia post-caesarean section.

Age, parity, previous incisional scar, gestational diabetes, preoperative low albumin level, type of anesthesia, duration of operation, perioperative blood transfusion, postoperative fever and chronic cough were found to not be associated with increase risk for hernia formation.

In conclusion, we can conclude from this study that the development of incisional hernia following lower midline cesarean section is uncommon but higher than previously reported. However, this remains one of the most important causes of morbidity in women of a relatively youthful age. Number of CSs, wound infection, and obesity are the most considerable associated factors. Reduction in fertility can reduce the risk of incisional hernia associated with cesarean delivery, a risk magnified by many successive CSs. In addition, measures to minimize postoperative wound infection may reduce the incidence. Other comorbidities (diabetes, heart disease and chronic obstructive pulmonary disease) were too infrequent to fully evaluate this association, which addresses the need for future cohort studies with larger samples.

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