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RESEARCH ARTICLE

THE RELATIONSHIP BETWEEN STRIAE GRAVIDARUM AND INTRA-ABDOMINAL ADHESIONS IN PREGNANT WOMEN WITH PREVIOUS CESAREAN SECTION

[1,*]Nasser K. Abd-Elaal, [1]Osama A. El Kelani, [1]Ibrahim A. Saif-Elnasr and [2]Amr M. El khyat

[1]Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University, Egypt
[2]Resident of Obstetrics and Gynecology at Ministry of Health, Dar Ismaiel maternity hospital–Alexandria, Egypt

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ABSTRACT

Objective: The aim of this study was to evaluate whether there was an association between abdominal striae gravidarum and intra-abdominal adhesions in pregnant women with a history of cesarean section.

Background: Intra-abdominal adhesions that develop because of prior abdominal or pelvic surgery may cause complications during surgery such as damage to the urinary bladder, uterus or small intestine; difficult intra-abdominal entry and hemorrhage.

Methods: The study was a prospective observational study. Patients in the study were 210 pregnant patients with a history of at least one cesarean section divided into 3 groups: A (70 patients with no striae), B (70 patients with mild striae) and C (70 patients with severe striae). Preoperatively patient`s abdominal striae were assessed using the Davey score; the severity of adhesions were evaluated intrao-peratively using the modified Nair score.

Result: No adhesions were found in 87 patients (grade 0), while 102 had grade 1–2 (filmy adhesions) and 21 had grade 3–4 (dense adhesions). Patients with no striae, there were no adhesions in 19 patients (21.8%), filmy adhesions in 36 patients (35.3%) and dense adhesions in 15 women (71.4%). Patients with mild striae, there were no adhesions in 27 patients (31.1%), filmy adhesions in 39 patients (38.2%) and dense adhesions in 4 patients (19.1%). Patients with severe striae, there were no adhesions in 41 women (47.1%), filmy adhesions in 27 patients (26.5%) and dense adhesions in 2 patients (9.5%). (sensitivity 81.2%; specificity 54.02 %; positive predictive value 67.14%; negative predictive value 67.14 %; Accuracy70%)(p value < 0.001).

Conclusion: The adhesion score decreased significantly when the striae score was high ($p < 0.0001$) denoting statistically significant value with negative correlation.

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INTRODUCTION

Caesarean section is one of the commonest operations performed In addition to the increasing rates in developed countries **(**World Health Organization, 2009**).** The majority of these proceed smoothly and safely; however, caesarean section is a major open abdominal procedure, often performed in an emergency setting, the incidence of re-laparotomy after caesarean section is 0.12–1.04% **(**Ragab *et al*., 2015**).** Although the incidence of intra-abdominal adhesions is low in patients with no history of abdominal surgery or cesarean section, the probability of adhesion formation has been reported to be 7% after primary cesarean delivery, rising to 68% following a third cesarean section**(**Rossouw, 2013**).** Moreover, the presence of adhesions during surgery may result in longer operating times and increase intra-operative complications, including damage to the bowel, bladder, ureters, and bleeding **(**Di Zerga, 1990**).** After trauma and/or injury to the peritoneum, there is increased vascular permeability in vessels supplying the damaged area, followed by an exudation of inflammatory cells, ultimately leading to the formation of a fibrin matrix, The fibrin matrix is gradually organized and replaced by tissue containing fibroblasts, macrophages and giant cells, This fibrin matrix connects two injured peritoneal surfaces forming fibrin bands. These fibrin bands can be broken down by fibrinolysis into smaller molecules as fibrin degradation products (FDP) **(**Tulandi, 1998**)**. If fibrinolysis does not occur within 5-7 d of the peritoneal injury, the temporary fibrin matrix persists and gradually becomes organized with collagen-secreting fibroblasts. This process leads to peritoneal adhesion formation **(**Holmdahl, 1999; Rout, 2003. Striae are visible, linear scars, which form in areas of dermal damage produced by stretching of the skin.

Corresponding author: **Nasser K. Abd-Elaal,**
Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University, Egypt.

They are characterized histologically by thinning of the overlying epidermis, with fine dermal collagen bundles arranged in straight lines parallel to the surface (Burrows *et al*., 2010). A study showed that dysfunctional fibroblasts, which are metabolically effective in healthy tissues in the absence of striae, were present in individuals with striae, results of in vitro tests indicate that fibroblasts derived from healthy-looking regions of skin of patients with stretch marks are metabolically affected and functionally dormant, diminishing their potential for proper produce of collagen, response to persistent mechanical stretching and repair of damaged extra-cellular matrix **(**Mitts *et al*., 2005**)**.defected fibroblastic cells play the same role in pathogenesis of the formation of intra-abdominal adhesions and striae gravidarum, so we intended to answer the question whether if there is an association between abdominal striae gravidarum and intra-abdominal adhesions in pregnant women with a history of cesarean section.

PATIENTS AND METHODS

This was a prospective observational study which was conducted on 210 pregnant women were recruited from those attending outpatient clinics of Menoufia university hospitals and Dar Ismaiel maternity hospital – Alexandria with history of at least one cesarean section. The participants were divided into three groups: Group A: seventy patients with no striae, Group B: seventy patients with mild striae, Group C: seventy patients with severe striae, according to the Davey scoring system (Davey, 1972). The sample size and the number of the study groups were categorized after the recommendations of the Biostatistics and public health department in the University of Menoufia. The University of Menoufia ethical committee approved the study. All the participants were counseled about the nature of study and have signed an informed consent. The criteria of the patients who have been included in this study was as follows: only those with previous cesarean operations performed in a hospital using the Pfannenstiel technique was enrolled in this study, patients were examined just prior to surgery irrespective to the gestational age and striae of all colors were counted during abdominal skin examinations.

The following cases have been excluded from this study: pregnant women who had conditions that might cause adhesion formation, such as pelvic inflammatory disease, prior abdomino-pelvic surgery other than cesarean section or a history of endometriosis, pregnant woman who had developed wound site infections following prior cesarean section and those who had a history of corticosteroid use that might cause striae formation. Assessment of the patients included history taking with particular aspect relevant to this study, general examination, abdominal examination to measure the fundal level, Socio-demographic properties of the patients age, smoking status, parity, body mass index (BMI), gestational week of the current CS delivery, the baby's birth weight, and weight gain during the pregnancy, diabetic status of the patient, present chronic diseases, current pregnancy complications and number of previous CS deliveries. Assessment of degree of striae gravidarum by applying Davey scoring system preoperatively and assessment of the degree of intra-abdominal adhesions by applying a modified Nair's scoring system intra-operatively. Davey scoring system was applied as follow: the abdomen was divided into four quadrants, using the midline and a line drawn horizontally through the umbilicus as references, Each quadrant was given a score, with 0 denoting clear skin, 1 a moderate (1–3) number of striae, and 2 many (≥ 4) striae. The sum of the scores of all four quadrants was calculated to obtain the final striae score. Patients with no striae were classified into the "no striae" group, patients with total striae scores of 1 or 2 were classified into the "mild striae" group and patients with scores between 3 and 8 were classified into the "severe striae" group(Davey, 1972).. Nair *et al*. described their scoring system for intra-abdominal adhesions as follows: Grade 0: complete absence of adhesions; Grade 1: single band of adhesion between viscera or from one viscus to the abdominal wall; Grade 2: two bands either between viscera or from viscera to the abdominal wall; Grade 3: more than two bands between viscera or from viscera to the abdominal wall, Grade 4: multiple dense adhesions or viscera directly adherent to the abdominal wall, irrespective of number or extent of adhesive bands. A modified Nair's scoring system: according to this system, adhesions were classified into three categories, grade 0 if no adhesions were present, grade 1 and 2 if there were filmy intra-abdominal adhesions and grade 3 and 4 if dense intra-abdominal adhesions were present (Nair *et al*., 1974).

Data management

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 19, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated and the Shapiro-Wilk test for normality was performed. For normally distributed data, values were expressed as mean ± standard deviation and Independent samples T test was performed for comparison between two groups. For data that were not normally distributed median and interquartile range (expressed as 25th-75th percentiles) were calculated and Mann-Whitney test was used, for qualitative data, which describe a categorical set of data by frequency, percentage or proportion of each category, comparison between two groups and more was done using Chi-square test ($\chi 2$), Fisher's exact or Fisher-Freeman-Halton exact tests. For comparison between more than two means of parametric data, F value of ANOVA (analysis of variances) test was calculated. Correlation between variables was evaluated using Spearman correlation coefficient (r). Logistic regression was used to conclude the variables that can be utilized to devise the score which predict intra-abdominal adhesions and its degree among pregnant women with history of previous cesarean section. The Receiver Operating Characteristic (ROC) curve was done, to detect the area under the curve which reflects the sensitivity of abdominal striae gravidarum degrees in diagnosis of intra-abdominal adhesions and its degree among patients, and was carried out to test the discrimination power of the devised score to predict intra-abdominal adhesions in pregnant patients, significance was adopted at $p<0.05$ for interpretation of results of tests of significance (Dawson, 2001).

RESULTS

The mean age at pregnancy was 27.55 ± 4.82 years and the mean gestational age was 37.95 ± 1.28 weeks. When groups with and without striae were compared, no statistical significance were found with regard to smoking status, the presence of chronic disease, gestational diabetes, gestational age, fetal and pregnancy complications or number of previous cesarean sections however, there were statistical significant differences with the age of the studied women($p=0.003$),BMI (body mass index) ($p <0.001$), weight gain during pregnancy(p

< 0.001), and fetal birth weight(p= 0.004), while the severity of striae gravidarum increases with the increased fetal birth weight , BMI and weight gain during pregnancy of the studied women(positive correlation),the severity decreases with the increased age of the studied patients(negative correlation) (Table 1).

Table 1. Demographic Characteristics of patients with or without striae gravidarum according to Davey score

	No striae	Mild striae	Severe striae	P value
Age*	28.71±4.82	27.93±5.12	26.01±4.13	0.003 a
Smoking **				0.706 b
➢Yes	3 (4.3%)	4 (5.7%)	2 (2.9%)	
➢No	67 (95.7%)	66 (94.3%)	68 (97.1%)	
BMI*	28.01±1.69	28.15±1.54	30.53±1.66	0.0001 a
Gestational diabetes mellitus**				0.554 b
➢Yes	3(4.3%)	1 (1.4%)	3 (4.3%)	
➢No	67(95.7%)	69(98.6%)	67(95.7%)	
Chronic diseases**				0.211 b
➢Yes	6 (8.6%)	8 (11.4%)	4 (5.7%)	
➢No	64 (91.4%)	62 (88.6%)	66 (94.3%)	
Weight gain during pregnancy*	10.49±1.13	11.38±1.15	12.30±1.21	0.0001 a
Fetal birth weight*	3557.14± 360.18	3575.71± 286.63	3722.86± 316.31	0.004 a
Number of previous cesarean sections**				0.093 b
➢1	29 (41.4%)	32 (45.7%)	42(60%)	
➢2	23 (32.9%)	27 (38.6%)	22(31.4%)	
➢> =3	18 (25.7%)	11(15.7%)	6(8.6%)	
Gestational age*	37.71±1.46	38.00±1.15	37.95±1.28	0.132 a
Current pregnancy complications**				0.198 b
➢Yes	7(10%)	5 (6.1%)	4 (5.7%)	
➢No	63(90%)	65(92.9%)	66(94.3%)	

Abbreviations:*: mean ± standard deviation (SD); **: n (%); a: f -value ANOVA; b: $\chi 2$ test; BMI: body mass index; p < 0.05: statistically significant

When patients were compared regarding to the presence of adhesions, no statistical significance were found in terms of BMI, weight gain during pregnancy, pregnancy complications, cigarette smoking, the presence of chronic disease or gestational diabetes; however, a statistically significant association was found between intra-abdominal adhesions and the number of previous cesarean sections (p<0.001),age of the patient (p=0.005), gestational age(p=0.02)and fetal birth weight(p=0.04),while the degree of intra-abdominal adhesions increases with the increased number of previous cesarean sections and age of the patients (positive correlation) , the degree decreases with the increased gestational age and fetal birth weight (negative correlation) (Table 2). In this study, the association between the presence of striae and intra-abdominal adhesions was evaluated in pregnant women with a history of cesarean sections, and a statistically significant association was found between them.

No adhesions were noted in 87 pregnant women, while 102 had grade 1–2 (filmy adhesions) and 21 had grade 3–4 (dense adhesions). Patients with no striae (n=70), there were no adhesions (score0) in 19 patients (21.8%), there were filmy adhesions (score 1-2) in 36 patients (35.3%), and there were dense adhesions in 15 women (71.4%). Patients with mild striae (n=70), there were no adhesions in 27 patients (31.1%), there were filmy adhesions (score1-2) in 39 patients (38.2%) and there were dense adhesions (score3-4) in 4 patients (19.1%). Patients with severe striae (n=70), there were no adhesions in 41 women (47.1%), there were filmy adhesions (score1-2) in 27 patients (26.5%) and there were dense adhesions (score3-4) in 2 patients (9.5%) (Table 3) (Figure 1). According to these results, the adhesion score decreased when the striae gravidarum score increased (p < 0.001 denoting statistically significant value with negative correlation). Sensitivity, specificity, positive and negative predictive values and accuracy (%) of abdominal striae gravidarum for diagnosis of intra-abdominal adhesions among the studied pregnant women with history of previous cesarean section were calculated (sensitivity 81.2%; specificity 54.02 %; positive predictive value 67.14%; negative predictive value 67.14 %; Accuracy70%) (Table 4).

The studied patients were assorted into two groups: A and B, the data of group A were utilized to develop a scoring system to predict intra-abdominal adhesions in the studied patients, and then the new score was applied on patients of group B, the data of groups A and B were compared to ensure matching of the two groups. The results of logistic regression analysis showed that the number of previous cesarean sections had significant relationship with the density of intra-abdominal adhesions, both the severity of striae (as indicated by Davey score) and the age of the patient had p values above 0.05; but they affected significantly the R2 value, therefore, these three variables have been used as parameters for developing the predictive score (Table 5).

The present study constructed a new score for prediction of the density of intra-abdominal adhesions based on data obtained from group A of the studied patients , parameters used in the score were given scoring points from 0 - 2 for each parameter according to their grading: the highest grade was given score 2 and lowest grade was given score 0. The maximum score is 6 and the minimal score is 0 (Table 6). The area under ROC curve for the predictive score for intra-abdominal adhesions in group A was 0.821, the cut off point for dense adhesions was more than 4.

The score identified 66.67 of patients with dense adhesions (sensitivity = 66.67%) and 90.62% of patients with no/filmy adhesions (specificity = 90.62)(Table 7)(Figure 2). The area under ROC curve for the predictive score for intra-abdominal adhesions in group B was 0.868, the cut off point for dense adhesions was more than 4. The score identified 66.67% of patients with dense adhesions (sensitivity = 66.67%) and 88.17% of patients with no/filmy adhesions (specificity = 88.17) (Table 8) (Figure 3).

Table 2. Demographic Characteristics of patients with or without adhesions according to the modified Nair adhesion score

	No adhesions	Filmy adhesions	Dense adhesions	P value
Age	26.93±4.59	27.52±4.85	30.28±4.88	0.005 a
Smoking				0.968 b
➢Yes	4(4.6%)	4(3.9%)	1(4.8%)	
➢No	83(95.4%)	98(96.1%)	20(95.2%)	
BMI	29.13±1.98	28.80±2.02	28.41±1.90	0.260 a
Gestational diabetes				0.767 b
➢Yes	2(2.3%)	4(3.9%)	1(4.8%)	
➢No	85(97.7%)	98(96.1%)	20(95.2%)	
Chronic diseases				0.388 b
➢Yes	5(5.7%)	10(9.8%)	3(14.3%)	
➢No	82(94.3%)	92(90.2%)	18(85.7%)	
Weight gain during pregnancy	11.52±1.48	11.40±1.28	11.81±1.31	0.106 a
Fetal birth weight	3678.16± 286.69	3593.14± 316.31	3495.24± 490.38	0.040 a
Number of previous cesarean sections				0.0001 b
➢1	56(64.4%)	46(45.1%)	1 (4.8%)	
➢2	25(28.7%)	42(41.2%)	5(23.8%)	
➢> =3	6(6.9%)	14(13.7%)	15(71.5%)	
Gestational age	38.19±1.06	37.86±1.24	37.38±1.96	0.020 a
Current pregnancy complications				0.064 b
➢Yes	4(4.6%)	8(7.8%)	4(19%)	
➢No	83(95.4%)	94(92.2%)	17(81%)	

Abbreviations:*: mean ± standard deviation (SD); **: n (%); a: f -value ANOVA; b: $\chi 2$ test; BMI: body mass index; $p < 0.05$: statistically significant

Table 3. Relationship between degree of intra-abdominal adhesions and abdominal striae gravidarum (n=210)

Abdominal striae gravidarum degree	Degree of intra-abdominal adhesions among the studied pregnant women (n=210)							
	No adhesions (scored 0) (A) (n=87)		Filmy intra-abdominal adhesions (scored 1-2) (B) (n=102)		Dense intra-abdominal adhesions (scored 3-4) (C) (n=21)		Total (n=210)	
	n	%	n	%	n	%	n	%
No striae	19	21.8	36	35.3	15	71.4	70	33.3
Mild striae	27	31.0	39	38.2	4	19.0	70	33.3
Severe striae	41	47.1	27	26.5	2	9.5	70	33.3
χ^2 P	24.846** 0.0001*							
χ^2 (P)	A vs B, 9.19, P=0.010* A vs C, 20.070, P=0.0001* B vs C, 9.440, P=0.009*							

Abbreviations: All values: n (%); *significant (P<0.05); **$\chi 2$: chi square test

Table 4. Sensitivity, specificity, positive and negative predictive values and accuracy (%) of abdominal striae gravidarum for diagnosis of intra-abdominal adhesions (n=210)

Variable	Sensitivity %	Specificity %	Positive predictive value %	Negative predictive value %	Accuracy %
Abdominal striae gravidarum as diagnostic of intra-abdominal adhesions	81.20%	54.02%	71.43%	67.14%	70.00%

Table 5. Logistic regression analysis for data of the studied patients to conclude the predictors of intra-abdominal adhesions among the patients of group A (N = 105)

Chi square test		Nagelkerke R Square	Variables	Coefficient	Standard Error	p	Odds ratio	95% CI for odds ratio	
X^2	p							Lower	Upper
21.046	<0.001*	0.41	Davey score striae	-1.838	0.988	0.063	0.159	0.023	1.103
			Age of patient	-0.290	0.163	0.075	0.748	0.543	1.030
			Number of previous CS	2.322	0.776	0.003*	10.194	2.228	46.648
			Constant	1.653	3.417	0.629	5.223		

CS: cesarean section; * significant at p <0.05; CI: confidence interval.

Table 6. The design of predictive score for the density of intra abdominal adhesions among the studied sample

Parameters			Score
	0	1	2
striae gravidarum (Davey score)	severe striae	mild striae	no striae
Number of previous caesarian sections	1	2	> 2
Age of the patients (years)	<25	25 - 30	>30

Table 7. ROC curve for the predictive score of the density of intra-abdominal adhesions in group A

	AUC	Standard error	95% CI for AUC	p	Cut off value	Sensitivity	Specificity
Dense Intra-abdominal adhesions	0.821	0.081	0.734 - 0.889	<0.001*	> 4	66.67%	90.62%

AUC: area under the curve; CI: confidence interval; * significant at p <0.05.

Table 8. ROC curve for the predictive score for intra-abdominal adhesions in group B

	AUC	Standard error	95% CI for AUC	p	Cut off value	Sensitivity	Specificity
Dense Intra-abdominal adhesions	0.868	0.054	0.762 - 0.974	<0.001*	> 4	66.67%	88.17%

AUC: area under the curve; CI: confidence interval; * significant at p <0.05.

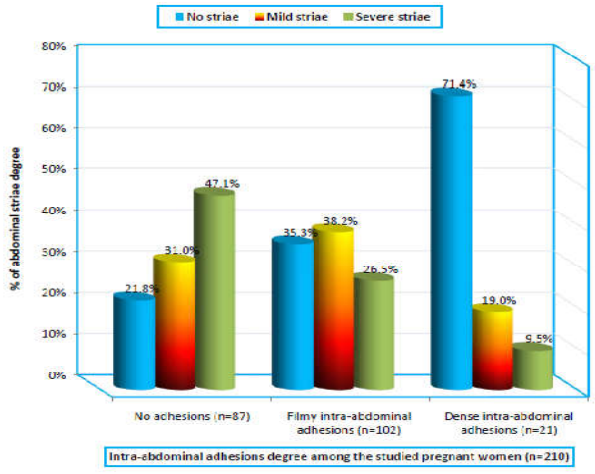

Figure 1. Relationship between degree of intra-abdominal adhesions and abdominal striae gravidarum degree (n=210)

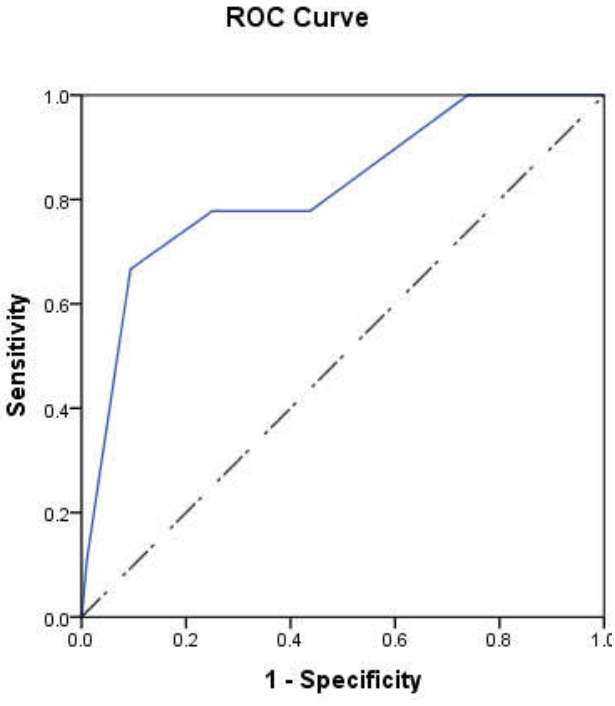

Figure 2. ROC curve for the predictive score of the density of intra-abdominal adhesions in group A

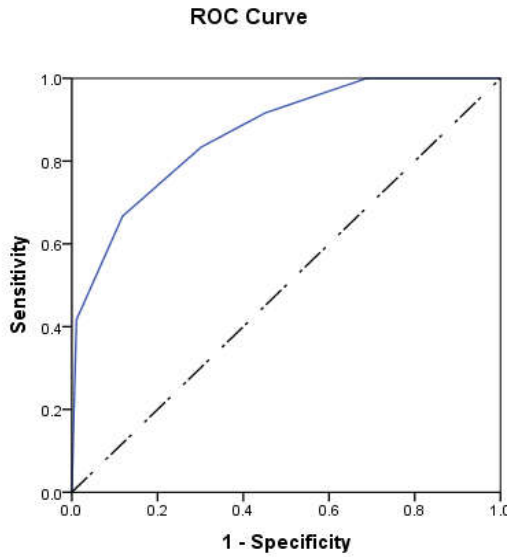

Figure 3. ROC curve for the predictive score of the density of intra-abdominal adhesions in group B

DISCUSSION

Peritoneal adhesions are a major cause of morbidity, resulting in multiple complications, many of which may manifest several years after the initial surgical procedure (Parker, 2004). Predicting of intra-abdominal adhesions is essential to prevent complications by ensuring that the necessary preoperative preparations are in place and/or that appropriate cases are referred to a tertiary center (Dogan, 2016). It has been demonstrated that adhesion tissue contains collagen fibrils produced by fibroblasts that are located in the extracellular matrix, also it has been proved in vitro that defective fibroblasts play a role in striae formation by producing less collagen, they suggest that stretch marks develop only in certain individuals whose genetic profile or actual metabolic status is compromised (Mitts *et al*., 2005). In disagreement with our study (Gungor *et al*) reported there were no significant differences between striae gravidarum with regard to age of the patient, new born birth weight, BMI before pregnancy, and weight gain during pregnancy (Gungor *et al*., 2014). (Dogan *et al*) in agreement with our study reported there were significant differences between striae gravidarum

with regard to new born birth weight, BMI before pregnancy, and weight gain during pregnancy (positive correlation) but not as regard to the age of the patient **(**Dogan *et al*., 2016**).** In disagreement with our study (Gungor *et al*) found no statistical differences between intra-abdominal adhesions in terms of age of the patient, gestational age, fetal birth weight and the number of previous cesarean sections **(**Gungor *et al*., 2014**).** (Dogan *et al*)In disagreement with our study found no statistical differences between intra-abdominal adhesions in terms of age of the patient, gestational age and fetal birth weight, but in agreement with our study found a statistically significant association between abdominal adhesions and the number of previous cesarean sections (positive correlation)(p = 0.017) (Dogan *et al*., 2016). In agreement with our study (Gungor *et al*) and(Dogan *et al*)found no statistical differences between intra-abdominal adhesions in terms of BMI, weight gain during pregnancy, cigarette smoking, the presence of chronic disease or gestational diabetes (Dogan *et al*., 2016; Gungor *et al*., 2014). In our study, the adhesion score decreased significantly when the striae score increased ($p < 0.001$ denoting statistically significant value with negative correlation). In disagreement with our study that included a small number of patients (n = 55), (Gungor *et al*) reported that adhesions formation in pregnant women increased with the increased score of striae gravidarum, the sensitivity of the modality was 80.95%, the specificity was 50%, and the positive predictive value was 50%, while the negative predictive value was 80.95%, the limitation of their study was the small sample size (Gungor *et al*., 2014).

However, (Dogan *et al*) in agreement with our study found in a study of (247) pregnant women, both formation and intensity of adhesions were reduced in the presence of abdominal striae, the sensitivity was 55%,the specificity was 67%,the positive predictive value was 69%,the negative predictive value was 52% (Dogan *et al*., 2016**).** We suggest that the reduced adhesion formation seen in pregnant women with striae gravidarum is due to dysfunctional fibroblastic cells that play roles in both striae and adhesion formation, these defective fibroblasts produce less collagen in adhesion tissue during formation of the extracellular matrix, therefore, adhesion formation decreases. An attempt was made in our study to formulate a simple scoring system to predict the intensity of intra-abdominal adhesions in pregnant women with a history of cesarean section, which will support clinical decision-making and to assess the prognosis of the next scheduled cesarean section. The studied patients were divided into two groups: A(n=105) and B(n=105), the data of group A were utilized to develop the score, and then the new score was applied on patients of group B, the data of groups A and B were compared to ensure matching of the two groups. The construction of the predictive score was achieved through the following steps: Logistic regression analysis was conducted on data of patients in group A which showed that the number of previous cesarean sections had significant relationship with the density of intra-abdominal adhesions, both the severity of striae (as indicated by Davey score) and the age of the patient had p values above 0.05; but they affected significantly the R^2 value, therefore, these three variables have been used as parameters for developing the predictive score. The design of score for prediction of the density of intra-abdominal adhesions in the pregnant patients was performed using the above three variables, parameters used in the score were given scoring points from 0 - 2 for each parameter according to their grading: the highest grade was given score 2 and lowest grade was given score 0, the maximum score is 6 and the minimal score is 0 (table 6). Values of the predictive score as emerged from results of patients in group A were recorded, the area under ROC curve for the predictive score for intra-abdominal adhesions was 0.821, the cut off point for dense adhesions was more than 4, (sensitivity = 66.67%) and (specificity = 90.62) (Table 7) (Figure 2). The score was applied on patients of group B, the area under ROC curve for the predictive score for intra-abdominal adhesions in group B was 0.868, the cut off point for dense adhesions was more than 4, (sensitivity = 66.67%) and (specificity = 88.17) (Table 8) (Figure 3). This simple score can be used in pre-operative clinical assessment of the intensity of intra-abdominal adhesions in pregnant women with a history of cesarean section. As several methods have been used to predict adhesions after abdominal operations, high-resolution ultrasonography, magnetic resonance imaging and scar healing properties were the methods that were evaluated for this target. Estimating the likelihood of adhesions and related complications after prior surgery and assessing the severity of adhesion formation after surgery is not easy, anticipating adhesions is very important to prevent complications by ensuring that the necessary preoperative preparations are in place and/or that appropriate cases are referred to a tertiary center. As can be concluded from our study, the preoperative evaluation of abdominal striae gravidarum has emerged as a simple clinical affordable tool that can provide surgeons with information on the abdominal adhesion status in the preoperative period. The strength of our study was the large sample size. The limitations of this study were that we analyzed the associations between striae gravidarum and intra-abdominal adhesions in women with a history of at least one cesarean section irrespective to how many previous cesarean sections the patient had and the color of the striae was not taken into consideration.

Conclusion

As can be concluded from our study, the preoperative evaluation of abdominal striae gravidarum has emerged as a simple clinical affordable tool that can provide surgeons with information on the abdominal adhesion status in pregnant women scheduled for cesarean delivery because of previous cesarean section.

REFERENCES

Burrows NP and Lovell CR. 2010. Disorders of connective tissue. In: Burns T, Breathnach S, Cox N, Griffiths C, eds. Rook's textbook of dermatology. 8th edition, Vol.3, chapter 45. Blackwell publishing, Oxford, UK 45:5-6.

Dawson B and Trapp R. 2001. Reading the medical literature : Basic & Clinical Biostatistics. Lange Medical Book/ McGraw – Hill. Medical Publication Division, New York. 3rd ed., Ch. 7-9, PP 161-218 and Ch. 13, PP 305-314, 2001.

Di Zerga GS. 1990. The peritoneum and its response to surgical injury. *Prog Clin Biol Res.,* 358: 1–11.

Dogan A, Etras IE, Uyar I, Karaca I, Bozgeyik B, Toz E *et al*. 2016. Preoperative Association of Abdominal Striae Gravidarum with Intra-abdominal Adhesions in PregnantWomen with a History of Previous Cesarean Section: a Cross-sectional Stud,Geburtsh Frauenheilk 76: 268–272.

Gungor AN, Oguz S, Hacivelioglu S, Isik S, Uysal A, Gencer M, Cosar E. 2014. Predictive value of striae gravidarum

severity for intraperitoneal adhesions or uterine scar healing in patients with previous caesarean delivery. *J Matern Fetal Neonatal Med.,* 27: 1312–1315.

Holmdahl L and Ivarsson ML. 1999. The role of cytokines, coagulation, and fibrinolysis in peritoneal tissue repair. *Eur J Surg.,* 165: 1012-1019.

Mitts Tf, Jimenez F, Hinek A. 2005. Skin biopsy analysis reveals predisposition to stretch mark formation. *Aesthet Surg J.,* 25: 593–600.

Parker MC. 2004. Epidemiology of adhesions: the burden. Hosp Med 65: 330-336.

Ragab A, Mousbah Y, Barakat R, Zayed A, Badawy A. 2015. Re-laparotomy after caesarean deliveries: risk factors and how to avoid? *J Obstet Gynaecol.,* 35:1–3.

Rossouw JN, Hall D, Harvey J. 2013. Time between skin incision and delivery during cesarean. *Int J Gynaecol Obstet* 121: 82–85.

Rout UK and Diamond MP. 2003. Role of plasminogen activators during healing after uterine serosal lesioning in the rat. *Fertil Steril.,* 79: 138-145.

Tulandi T, Chen MF, Al-Took S,Watin K. 1998. A study of nerve fibers and histopathology of postsurgical, post infectious and endometriosis-related adhesions. Obstet. Gynecol. 92: 766-768.

World Health Organization. Rising caesarean deliveries in Latin America: how best to monitor rates and risks .Geneva: World Health Organization, 2009 (http://apps.who.int/iris/bitstream/10665/70034/1/WHO_RHR_09.05_eng.pdf).

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