



Assessment of the relation of striae gravidarum and scar characteristics with peritoneal adhesions in patients with previous cesarean section

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Abstract

Background Cesarean section is the most common major obstetric surgery and oldest operation in the field of abdominal surgery.

Aim of the study : to evaluate the role of striae gravidarum and scar characteristics in the prediction of peritoneal adhesions in patients with previous one cesarean section.

Patient and method :In this cross-sectional study, we evaluated 113 pregnant women at > 36 weeks of gestation ,had previous one cesarean delivery(regardless the indication of the previous c/s) who admitted to the gynecology and obstetric unit of Salah al-deen general hospital and underwent their second (emergency or elective) cs ,study done over a period from 15th December 2021 to 15th May 2022 . All participants gave informed consent before being included in the study.. An interview was carried out with these patients using questionnaire form .The study authorized by department of gynecology and obstetric in Tikrit university/college of medicine. Half of sample evaluated for SG (have flat non pigmented scar) and other half evaluated for scar characteristics (davey's score=0).

Results :Average age(18-42) year, GA(36 - 40+2) weeks,64% of cases are >38 wks, BMI range (24-34.4),only 4 patients were smokers .Also 64% of participants are P1. 56.6% of cases had peritoneal adhesion(PA) in varying degrees. Increasing GA,BMI shows significance relation with mild and severe SG(p-value =0.044,0.004)respectively , depressed scars and pigmented one appear to be more prominent when BMI(25-30)(p-value=0.007) and time since previous c/s was ≥2 years(p-value=0.047). Scar pigmentation found to be more in P1 women(p-v=0.035). keloid scar correlate significantly with gap between c/s < 2 years(p-value=0.015). Higher degrees of peritoneal adhesions were found in cases with severe SG(p-value=0.0006), although mild adhesions correlate with mild SG. Severe adhesions found obviously in depressed scars and pigmented scars found in 58.8% of the cases which had PA(p-value=0.0006). Scar length >13 cm associated with presence of PA in 75.7% of study sample,(p-value=0.032).

Conclusions : Abdominal striae gravidarum are significant predictor for intra peritoneal adhesions. Women with severe striae gravidarum had severe intraperitoneal adhesions. Cesarean skin scar pigmentation and presence of non-flat scars "depressed specifically" could be associated with the presence of intra-abdominal peritoneal adhesions during repeatCD. Increasing scar length can predict

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peritoneal adhesions**Keywords:** striae gravidarum; scar characteristics; peritoneal adhesions; cesarean section**DOI Number:** 10.14704/nq.2022.20.8.NQ44917**NeuroQuantology 2022; 20(8): 8973-8984****Introduction**

Cesarean delivery (CD) is one of the most commonly performed surgical operations worldwide. Repeated surgery can lead to numerous serious complications⁽¹⁾, such a difficult intra abdominal entry; injury to the urinary bladder, uterus or small intestine, longer operation time, and increased blood loss. Every year, CD rates increase, and after each operation, the rate of peritoneal adhesions may also increase⁽²⁾. Adhesions are abnormal bonds between the surfaces of anatomical structures, can present with varying severity after repeated intra -abdominal or pelvic surgeries⁽³⁾. The incidence of adhesions after abdominal surgery varies from 55 to 66%. Adhesions occur through inflammation and coagulation processes, triggered by surgery, injuries or irritation, , together with a decrease in fibrinolytic activity, that will result in the deposition of organized extracellular matrix (ECM) and adhesion formation⁽⁴⁾. Striae gravidarum (SG) also called striae distensae is a common condition observed in pregnancy to various extents. During pregnancy fast stretching of the skin leads to cleavage of collagen fibers that may cause easy separation ,striae gravidarum is thought to be due the poor skin elasticity⁽⁵⁾. SG appears in the second and third trimester of pregnancy, typically on the abdomen and breasts and less commonly on the buttocks, hips and thighs. These stretch marks usually start as 'reddish depressed streaks' and whiten during pregnancy and leave pale, unharmed and cosmetically undesirable skin lesions⁽⁶⁾. Wound healing is a mechanism whereby the body attempts to restore the integrity of the injured part. This falls far short of tissue regeneration by pluripotent cells, and is often detrimental, as seen in the problems created by scarring, such as adhesions, keloids and contractures⁽⁷⁾. Several factors may influence healing. However, a clean incised wound in a healthy person where there is no skin loss will follow a set pattern taking place in three phases; the inflammatory phase, the proliferative phase and the remodelling phase

(maturing phase) .The epidermis at the site of the abdominal scars demonstrates delicate well-organized collagen bundles arranged parallel to each other⁽⁸⁾. However, scars do not heal similarly, raising the suggestion of a possible relationship to intra-abdominal adhesions. The similarity in the formation of these changes raised the possibility of using abdominal striae and scar appearance as predictive tools for the severity of peritoneal abdominal adhesions⁽⁹⁾. The **aim of the study was to** evaluate the role of striae gravidarum and scar characteristics in the prediction of peritoneal adhesions in patients with previous one cesarean section (c/s).

Patient and method

In this cross-sectional study, we evaluated 113 pregnant women at > 36 weeks of gestation ,had previous one cesarean delivery (regardless the indication of the previous c/s) who admitted to the gynecology and obstetric unit of Salah al- deen general hospital and underwent their second (emergency or elective) cs. Data collection done over a period from 15th December 2021 to 15th May 2022. The study had been authorized by department of gynecology and obstetric in Tikrit university/college of medicine. Half of sample (n=56) evaluated for striae gravidarum (have flat non pigmented scar), while the other half of study sample (n=57) evaluated for scar characteristics (davey's score=0). The study carried out on patients admitted to the unit fulfilling the following inclusion and exclusion criteria:

Inclusion criteria: a) patients with previous one CS. b) patients presenting for emergency or elective CS.

Exclusion criteria: a) History of SG in previous pregnancies or family history of SG. b) history of wound infection and complications. c) history of endometriosis. d) other abdominal operations other than CS. e) chronic steroid therapy. f) Cushing disease, adrenal hyperplasia, Ehlers- Danlos syndrome and Marfan syndrome. g) multiple pregnancy. h) polyhydramnios

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3-4- Preoperative evaluation:

a- including **personal data:** age, current weight, height , body mass index (BMI), smoking habit.

obstetrical history :parity(P) ,period from last cs, gestational age (GA) in weeks.

b-Evaluation of striae gravidarum: By inspection of abdomen after exposure

,using Davey's scoring system, in this scoring

•0 (absent)

1 to 2(mild) •

•3 to 8 (severe)

C- assessment of scar characteristics: By abdominal inspection, we recorded the color of the scar according to the pigmentation (hyper pigmented or non pigmented), the level of the scar that categorized as (depressed, flat or elevated), Scars were categorized in relative to the level of the surrounding skin. Flat scar defined as a scar flushed with the skin and seen as a line not depressed or elevated. Depressed scar is seen as a dimpled scar or depressed below the skin surface. Elevated scar is hypertrophied scar seen above the level of the skin. Presence of keloid will also recorded. And the length of scar measurement by ruler in cm.

3-5- Evaluation of intra abdominal peritoneal adhesions(PA): will be evaluated during surgery according to the Nair scoring system. According to this system, following definitions were made:

grade 0 = no band of adhesion seen in the intra abdominal examination. grade 1 = the presence

system the abdomen is divided into 4 quadrants using the midline and horizontal line through the umbilicus. Each quadrant was scored as 0(=clear skin), 1= (1-3 striae in each quadrant)or 2=(>4 striae in each quadrant).Total sum of scores ranged from 0 to 8. The severity of striae gravidarum was divided into three categories:

of single band between viscera or between viscera and anterior abdominal wall .

grade 2 = the presence of two bands between viscera or between viscera and anterior abdominal wall .

grade 3 = the presence of more than two bands between viscera or between viscera and anterior abdominal wall .

grade 4 = Multiple dense adhesions or viscera directly adherent to the anterior abdominal wall, irrespective of number or extent of adhesive bands.

Results

The study sample included 113 pregnant women with previous one c/s. Average age (18-42) year, GA(36 – 40) weeks, 64% of cases were >38 wks , BMI (24-34.4), 63.7% of participants are P1.75.3% of study sample had gap between cs ≥ 2 years and only 4 participants were smokers. These data presented in table (1).

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Table 1: Study sample statistics

variables		NO.	%
Age	18-30 yrs	79	70%
	31-42 yrs	34	30%
GA in weeks	36-38 wk	41	36.2%
	38 wk>	72	63.8%
BMI	<25	6	5.3%
	25-30	51	45.1%
	>30	56	49.6%
Gap between cs	<2 yrs	28	24.7%

	≥2 yrs	85	75.3%
Parity	P1	72	63.7%
	P2 and more	41	36.3%
smoking	yes	4	3.5%
	No	104	96.5%

Regarding scar characteristics ;scar level ,pigmentation and keloid presence ,nosignificant relation found with age ,GA and smoking. while depressed scars and pigmented one appear to be more prominent when BMI(25-30)(p-value=0.007)and time since previous c/s was ≥2 years(p-value=0.047). Scar pigmentation found to be more in P1 women(p-v=0.035). keloid scar correlate significantly with gap between c/s < 2 years (p-value=0.015).These results represented in table 2,3.

Table 2: Relation between patient demographics and scar pigmentation

Patient demographics		Scar pigmentation						Significance
		Pigmented		Non pigmented		Total		
AGE	81-03	14	60.8%	65	72.2%	97	69.9%	P-Value = 0.289
	08-24	9	39.2%	25	27.8%	43	30.1%	
Total		23	100%	90	100%	880	100%	
GA in weeks	36-38	6	26%	35	38.8%	34	36.2	P-Value = 0.254
	>38	17	74%	55	61.2%	97	63.8	
Total		23	100%	90	100%	880	100%	
Smoking	Yes	0	0%	4	4.4%	3	3.5%	P-Value = 0.617
	No	23	100%	86	95.6%	407	96.5%	
Total		23	100%	90	100%	880	100%	
B M I	< 25	4	10%	3	3.3%	6	5.3%	P-Value = 0.0007
	25 - 30	44	50%	38	42.2%	14	45.2%	
	> 30	9	40%	49	54.5%	16	49.5%	
Total		40	100%	90	100%	880	100%	
Gap between C\S	< 2 Year	7	39.1%	19	21.1%	72	24.7%	P-Value = 0.055
	≥ 2 Year	43	60.9%	71	78.9%	21	75.3%	
Total		40	100%	90	100%	880	100%	
Parity	P1	47	82.6%	53	58.8%	97	63.7%	P-Value = 0.035
	P2& more	3	17.4%	37	41.2%	34	36.3%	
Total		40	100%	90	100%	880	100%	

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Table 3: Relation between patient demographics and keloid scar

Patient demographics		Keloid scar						significance
		Yes		No		Total		
AGE	81-03	5	83.3%	74	69%	97	69.9%	P-Value = 0.436
	08-24	1	16.7%	33	31%	43	30.1%	
	Total	6	100%	107	100%	880	100%	
GA in weeks	36-38	2	33%	39	36.4%	34	62.2%	P-Value = 0.877
	>38	4	67%	68	63.6%	97	63.8%	
	Total	6	100%	107	100%	880	100%	
Smoking	Yes	0	0%	4	3.7%	3	3.5%	P-Value = 0.439
	No	6	100%	103	96.3%	407	96.5%	
	Total	6	100%	107	100%	880	100%	
B M I	< 25	0	0%	6	5.6%	6	5.3%	P-Value = 0.511
	25 - 30	4	66.6%	47	43.9%	14	45.2%	
	> 30	2	33.4%	54	50.5%	16	49.5%	
Total	6	100%	107	100%	880	100%		
Gap between C\S	< 2 Year	4	66%	24	22.4%	72	24.7%	P-Value = 0.015
	≥ 2 Year	2	44%	83	77.6%	21	75.3%	
	Total	6	100%	107	100%	880	100%	
Parity	P1	5	83.3%	67	62%	97	63.7%	P-Value = 0.304
	P2&more	1	16.7%	40	48%	34	36.3%	
	Total	6	100%	107	100%	880	100%	

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In the first group who were assessed about SG(N=56) using Davey's scoring that is graded as (absent ,mild ,severe) .Severity of SG distributed as 14 case absent SG , 20 case mild SG , 22 case severe SG that represented in figure (1).

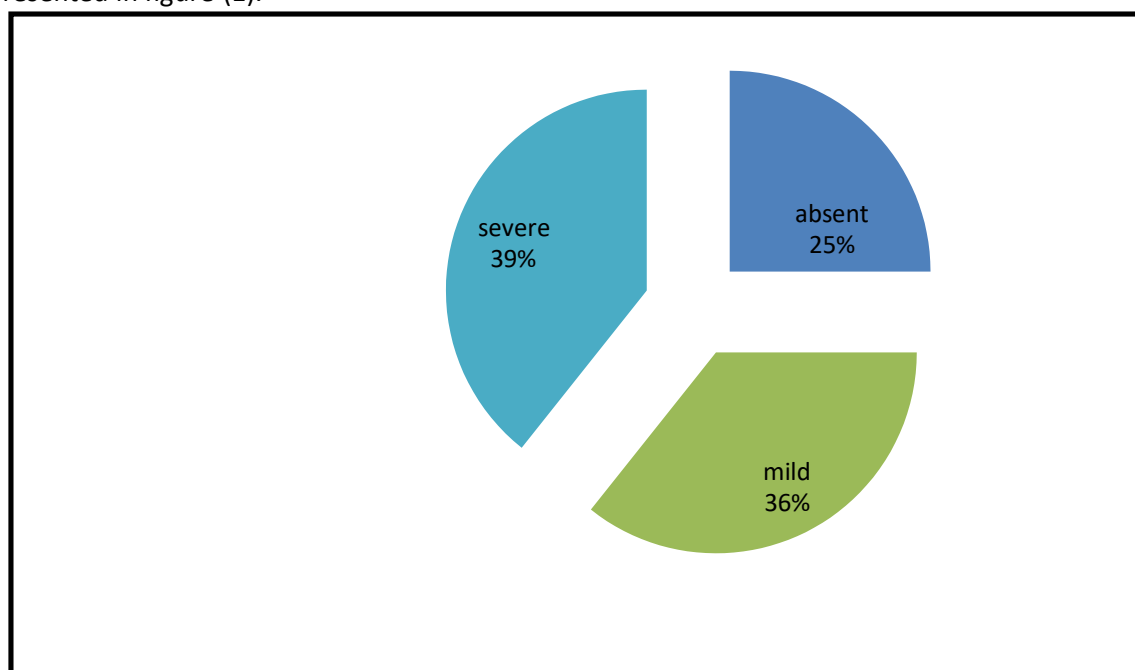


Figure 1: Distribution of SG severity in study group

In SG assessment group 60% of cases that reveal any degree of PA "according to Nair scoring" recognized in severe SG cases (p-value=0.0007) , as shown in table 4

Table 4: Relation of SG severity with PA presence.

Davey's score	Adhesion presence						significance
	Yes		No		Total		
Absent	4	3.3%	44	50%	43	25%	P value=0.0007
Mild	44	36.7%	7	34.6%	70	35.7%	
Severe	42	60%	3	15.4%	77	39.3%	
Total	40	100%	76	100%	16	100%	

Higher degrees of peritoneal adhesions were found in cases with severe SG(p-value=0.0006), although mild adhesions correlate with mild SG, as shown in table(5

Table 5: relation of SG severity with PA severity.

Davey's Score	Nair Score										total	
	0		1		2		3		4			
	N	%	N	%	N	%	N	%	N	%		
Absent	13	50%	1	9.1%	0	0%	0	0%	0	0%	14	%42
Mild	9	34.6%	7	63.6%	4	26.7%	0	0%	0	0%	20	35.7%
Severe	4	15.4%	3	27.3%	11	73.3%	3	100%	1	100%	22	39.3%
Total	26	100%	11	100%	15	100%	3	100%	1	100%	56	100%

P-Value = 0.0006

In order to evaluate the validity of scar shape , colour , length and keloid presence in predicting PA in the second group (N=57), 97.1% of PA found with non-flat scars, presented in table(4-8).

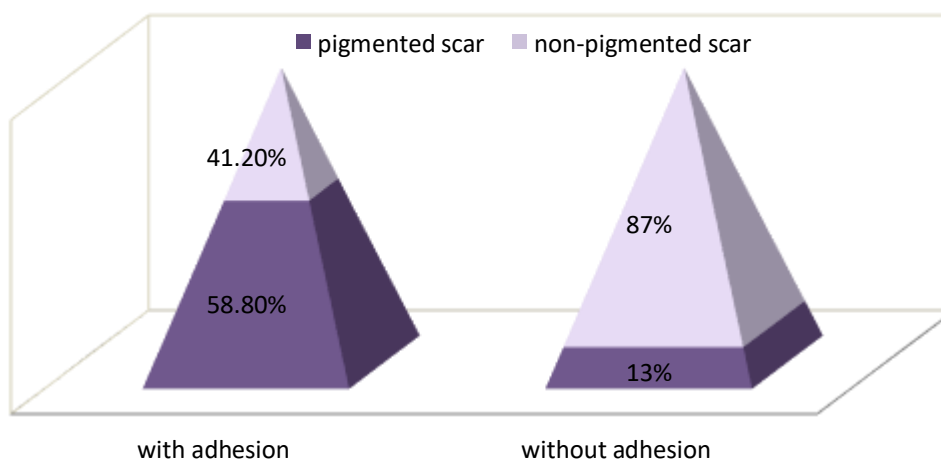
Table 6: Relation of scar level and PA presence.

Scar Level	Adhesion Presence					
	YES		NO		Total	
	N	%	N	%	N	%
Flat	1	2.9%	14	60.8%	15	26.3%
Non-Flat	33	97.1%	9	39.1%	42	73.7%
Total	34	100%	23	100%	57	100%

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P-Value = 0.0007

In correlation to scar color, pigmented scars found in 58.8% of the cases which had PA(p-value=0.0006) ,as drawn in fig 2



Cohesive adhesions found only in pigmented scars ,grade 1& 2 adhesion found mostly in pigmented scars (p-value =0.0003). This result represented in table 7:

Table 7 : Relation of scar pigmentation with nair score.

scar Pigmentation	Nair score										Total	
	0	1	2	3	3							
Pigmented	3	13 %	10 55.6%	7 58.3%	1 50%	2 100%	23	40.4%				
NonPigmented	20	87 %	8 44.4%	5 41.7%	1 50%	0 0%	33	59.6%				
Total	23	100 %	18 100%	12 100%	2 100%	2 100%	56	100%				

P-Value = 0.0003

In our study we evaluate the association of keloid scar with PA ,Keloid scar presence show no significant value in predicting PA ,as presented in fig.(4-3)and fig.(3). 8980

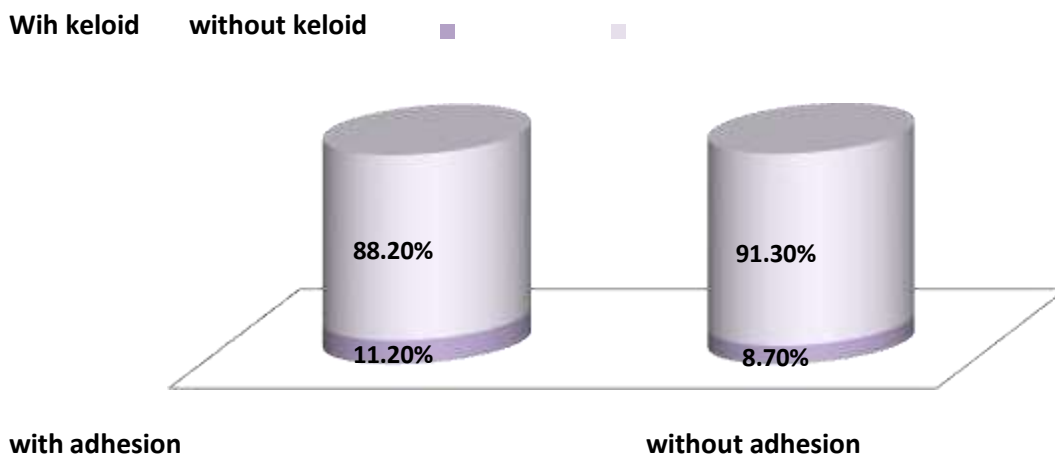


Fig 3: Relation of keloid scar to PA presence.

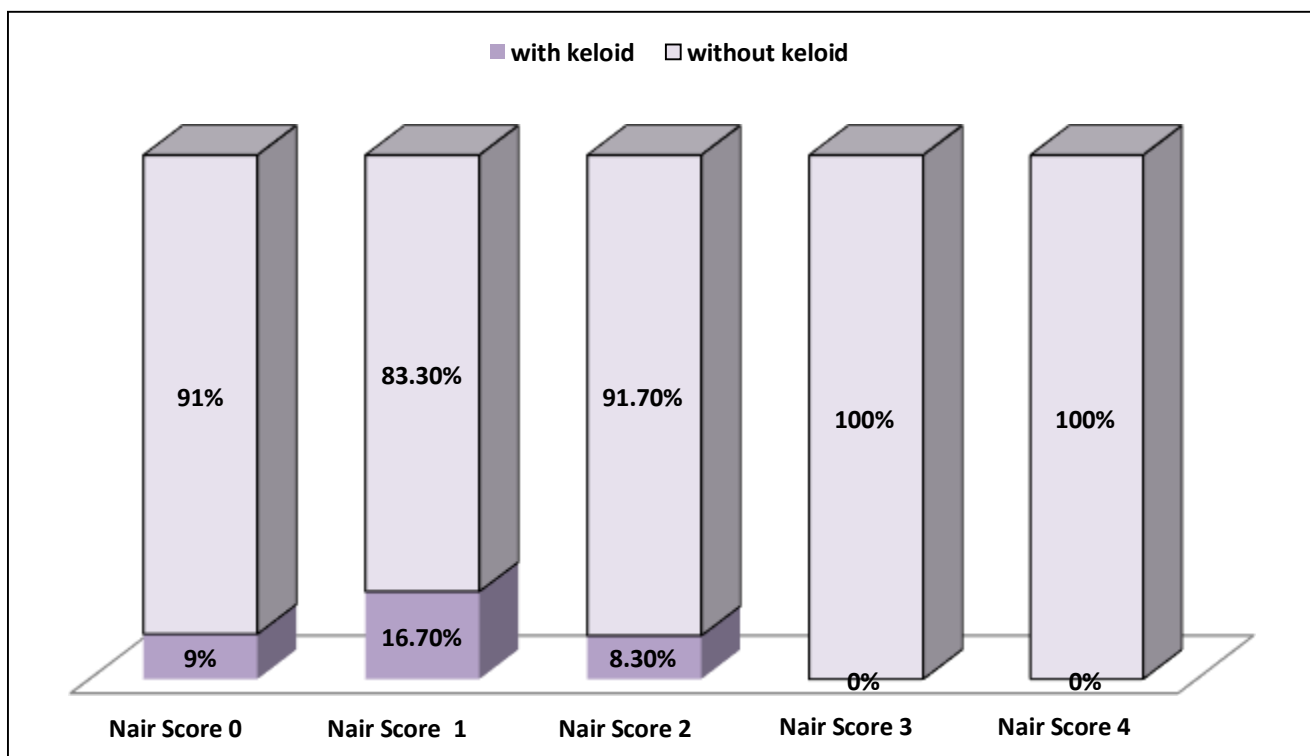


Fig 4: relation of keloid to PA presence.

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Regarding scar length association with PA ,scar length >13 cm associated with presence of PA in 75.7% of study sample,(p-value=0.032).The result presented in table 8

Table 8: The Relation of Scar length with presence of PA.

	Adhesion Presence						
	Scar Length	YES		NO		Total	
		N	%	N	%	N	%
Discussion The sub analysis performed for the study group demonstrated no significant relation of age to SG severity, explaining this result to young mean age taken. Also we didn't confirm relation of parity with SG due to dominance of P1 women in study sample . Relation of gap between c/s and SG was not significant in our study. Smoking relation to SG didn't approved ; due to small sample size with this variable. In the cross section study evaluation ,we found no differences in the demographic data of the	Length 10 – 12 cm	8	24.2%	13	56.5%	21	36.8%
	Length 13 – 15 cm	26	75.7%	10	47.8%	36	63.2%
	Total	34	100%	23	100%	57	100%

recruited population regarding the

for the study group demonstrated no significant relation of age to SG severity, explaining this result to young mean age taken. Also we didn't confirm relation of parity with SG due to dominance of P1 women in study sample . Relation of gap between c/s and SG was not significant in our study. Smoking relation to SG didn't approved ; due to small sample size with this variable. In the cross section study evaluation ,we found no differences in the demographic data of the

correlation of (age , GA , smoking) with scar level and colour and Sham et al⁽¹⁰⁾ agreed with our current study .This relation can't be estimated due to small number of smokers in study sample ,also no cases who are old age in our sample that aging could be reflected on the process of tissue healing and scarring. GA didn't affect on scar shape because these changes should be taken place in the few months after previous c/s not in the current pregnancy .However, we found that increasing

BMI and gap between c/s associated with non flat (depressed > elevated) and pigmented scars; this result showed up due to high number of cases who are overweight and cases who had gap between c/s more than 2 years, and increasing weight could lead to dysmorphic tissue healing. Scar pigmentation present predominantly in P1 cases because 63.7% of cases are P1. In our current study, 56.6% of participant found to have peritoneal adhesions. The high rate of adhesions could be related to our hospital as being the largest tertiary care center that introduces medical service to the governorate and women in the study had their primary c/s in different hospitals, so that surgical techniques used, suture materials, surgeons, sterilization method variabilities could be the reason for the high rate of adhesions reported in our study. Elprince et al⁽⁹⁾ and Abbas et al⁽¹⁾ agree with our results explaining this by the shared pathogenesis of SG and PA by formation of disorganized elastic fibers and high proportion of rigid cross-linked collagen, which makes the connective tissue prone to stress rupture. Neither of Dogan et al⁽¹¹⁾ and Bibi et al⁽¹²⁾ related between the severity of SG and PA proposed this to the following mechanism; the adhesion tissue contains collagen fibrils produced by fibroblasts that are located in the extracellular matrix. Dysfunctional fibroblasts, that have a role in striae, lead to the production of less collagen in adhesion tissue during formation of the extracellular matrix; therefore adhesion formation decreases. Many of the abdominal scar features were considered to have an association with adhesions by many authors, such as Elagwany et al⁽¹³⁾ and Altinboga et al⁽¹⁴⁾, who found that PA found mostly with depressed c/s scar which is the same result of our's that also showed the presence of severe adhesions only in depressed scars (p-value=0.0008). Assumed this to the idea that; to achieve perfect scar remodeling, collagen fibers are organized in a parallel fashion and tissue resulting from abdominal wound healing can reflect peritoneal healing which has been confirmed by several studies, and scar depression arise from the inward traction of skin from the adhesion bands. In elevated scars; increased collagen production is noted, thought to arise from variability in

transforming growth factor, which plays an essential role in the formation of hypertrophic scars as well as intra peritoneal adhesions. We came with the result that 97.1% of PA found with non-flat scars. While Flat scars were indicative of absent adhesions in our study. Altinboga et al⁽¹⁴⁾ and Elprince et al⁽⁹⁾ demonstrated the presence of PA s in hyper pigmented scars that agree with our findings, relating this result to the increase in melanin pigment in the skin increased both scar tissue severity and peritoneal adhesion formation. So, skin color of the patient alone provides important information about adhesion density. Therefore, it may be possible to predict the intra-abdominal adhesion density with greater accuracy with the combined use of different parameters. In contrast, Cim et al⁽¹⁵⁾ in his study demonstrated that non pigmented scars related significantly with PAs. The low proportion of operated patients with keloids in both studies did not allow conclusions to be drawn about its relationship to adhesion existence. However, subsequent studies could make it possible to exploit this pathway on the possible prediction of keloid scar on the occurrence of adhesions. While Taylan et al⁽³⁾ and Tulandi et al⁽¹⁶⁾ found keloid scar as strong predictor to PAs; because keloids display a histologic similarity with intraperitoneal adhesions. There is also excess production and deposition of extracellular matrix such as collagens, in keloids, as well as in adhesions. Salim et al⁽¹⁷⁾ and Cim et al⁽¹⁵⁾ concluded the same results claiming this to increase tissue disruption in longer scar promoting more pelvic adhesions formation. On the other hand; Khalaf et al⁽¹⁸⁾ reported non significant relation of scar length with peritoneal adhesions.

Conclusions

In conclusion, Abdominal striae gravidarum are significant predictor for presence of peritoneal adhesions. Women with severe striae gravidarum had severe peritoneal adhesions. Cesarean skin scar pigmentation and presence of non-flat scars "depressed specifically" associated with the presence of intra-abdominal peritoneal adhesions during repeat CD. Increasing scar length can predict peritoneal adhesions. keloid scar can't predict PAs

Recommendations

Adding evaluation of SG grade and cesarean skin scar characteristics to obstetrical examination. Inclusion of cesarean skin scar characteristics evaluation and striae gravidarum estimation in the pre-operative examination for women with previous CD.

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