e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(1); 28-33

Original Research Article

Stria Gravidarum: Is It a Predictor of Intra-Abdominal Adhesions or Not?

Sharma N[*1], Vegada D[2], Gandhi VS[3], Shah PK[4]

[1]Associate Professor, Department of Obstetrics and Gynaecology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

[2]Senior Resident, Department of Obstetrics and Gynaecology, Gujarat Cancer Society Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India

[3]Resident 3rd year, Department of Obstetrics and Gynaecology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

[4]Resident 2nd year, Department of Obstetrics and Gynaecology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

Received: 25-09-2023 / Revised: 28-10-2023 / Accepted: 30-11-2023
Corresponding author: Dr. Sharma N
Conflict of interest: Nil

Abstract:

Introduction: Caesarean section (CS) is a common obstetric procedure worldwide, and its rate has increased in recent times. Women with repeat cesarean sections are susceptible to postoperative complications such as injury to organs, vessels, fetus or postoperative obstruction requiring repeat surgeries. The reason for this could be intraperitoneal adhesions. Striae gravidarum (SG), characterized by linear skin changes, is a common pregnancy complication caused by dermal damage. The study aims to assess the role of SG in predicting intra-uterine adhesions in repeat caesarean sections.

Materials and Methods: A total of 100 pregnant females with one or more caesarean sections participated voluntarily in a prospective, observational study conducted at the Department of Obstetrics and Gynecology, Geetanjali Medical College and Hospital, Udaipur. Preoperatively, women were graded for striae gravidarum using Davy's scoring, and intra-abdominal adhesions were classified intraoperatively as per Modified Blauer's classification. The collected data was analyzed using Microsoft Excel 2016.

Results: The mean age of the participants was 26.6 years (SD±3.42). 86% had previous one CS, 12% had previous two CS, and 2% had previous three CS. All study participants (n=100) had striae gravidarum. Adhesions were present in 87% (n=87) of study subjects. The study found no significant correlation between SG and intra-abdominal adhesions. Factors such as age, parity, and mode of delivery showed no influence on the severity of SG. There was, however, a significant relationship between parity, past cesareans, inter-pregnancy gap, and intra-abdominal adhesions.

Conclusion: Finally, SG is not a reliable predictor of intra-abdominal adhesions in recurrent caesarean procedures.

Keywords: Striae Gravidarum, Intraabdominal Adhesions, Intraperitoneal adhesions, Davy's scoring system of Striae, Modified Blauer classification of adhesions.

Introduction

Caesarean section (CS) is a quotidian obstetric surgery performed by obstetricians worldwide [1,2]. It is performed to save the life of a mother and a fetus in certain situations. One-third of caesarean sections are repeated, and more than 90% of women who are undergoing caesarean section will have repeat Caesarean sections in subsequent pregnancies [3]. The incidence of CS in India has increased by 25% over the last decade [4].

Striae are linear skin alterations in areas of skin stretching. Dermal injury causes this to happen. Pregnancy-related stretching also results from obesity and Cushing syndrome. Upon closer inspection, they reveal themselves to be pinkish-purple and then depressed white lines. These regions exhibit a reduced extracellular matrix and lower collagen content histologically. Any surgical procedure will cause some tissue injury, and the body will react by increasing extracellular permeability and fibroblast and macrophage aggregation to create a fibrin matrix [5]. It is thought that the tissue healing routes for peritoneal adhesion, abdominal scar, and stria gravidarum formation are comparable [6]. This study aims to evaluate the role of striae gravidarum in predicting the presence of intra-uterine adhesions in repeat caesarean sections.

Materials and Methods:

A total of 100 pregnant females who have undergone one or more caesarean sections, irrespective of age and parity, participating voluntarily, were included in the study. Those women who had undergone any other abdominal surgery in the institute were excluded. Sample collection was done between February 2021 to June 2022.

The study design was a Prospective, Observational study conducted in the Department of Obstetrics and Gynaecology, Geetanjali Medical College and Hospital, Udaipur.

Case history, clinical examination, ultrasound and appropriate laboratory investigations like preoperative, postoperative haemoglobin, TLC, platelets, PT/INR, RBS, TSH, urea, creatinine, HIV, HBsAg and VDRL were taken of every patient before posting for elective or emergency CS.

History which was registered included maternal age, parity (taken in antenatal state), number of previous CS and previous perioperative complications. Indications of previous and present CS are classified according to Robson's Ten classification [7]. The clinical examination involved noting striae gravidarum according to the Davy scoring system [8]. Each quadrant was scored as 0(=clear skin), 1(=moderate number of striae) or 2(=many striae). The total sum of scores ranged from 0 to 8. The severity of striae gravidarum was divided into three categories: 0 (absent), 1 to 2 (mild), and 3 to 8 (severe), as assessed by Davey's score.

The intra-operative observation was taken into account for intra-abdominal adhesions according to Modified Blauer classification [9]: Grade 0: Complete absence of adhesions. Grade 1,2: Localized filmy easily separable adhesions. Grade 3: Dense, extensive adhesions. Grade 4: Adhesions of the intestines to the abdominal wall or to the uterus.

Results:

One hundred consenting antenatal females were included in the study as no one refused to participate, so a final analysis was done on them.

Table 1: Sociodemographic distribution of participants

Variables		**Number**
Age group (years)	**21-25**	41
	26-30	48
	31-35	10
	36-40	1
Mean age ± SD		**26.6 ± 3.42**
Area of living	**Rural**	30
	Urban	70
Parity	**1**	82
	2	15
	3	1
	4	2
Number of the previous caesarean	**1**	86
	2	12
	3	2

The mean age of the participants was 26.6 years (SD±3.42). The majority, 48% of participants, belonged to the age group of 26-30 years, 70% were from the urban area, and 82% had one parity (considered antenatally). Amongst all participants, 86% had previous one CS, 12% had previous two CS, and 2% had previous three CS (Table -1).

Table 2: Distribution of Striae Gravidarum according to Colour

Stria colour	**Number**
Rubra	70
Alba	30
Total	**100**

Table 3: Distribution of Striae Gravidarum with Area of Living

Score	**Total**	**Rural**	**Urban**
3-5	70	21	49
6	20	4	16
7	8	4	4
8	2	1	1
Total	**100**	**30**	**70**

Table 4: Distribution of Adhesions with Area of Living

Score	Total	Rural	Urban
0	12	5	7
1	56	16	40
2	27	6	21
3	5	3	2
Total	**100**	**30**	**70**

Amongst all 100 participants, 70% had striae rubra, and 30% had striae alba (Table 2). The majority of participants who had Davy's score between 3 and 5 belonged to urban areas. In scores 7 and 8, both rural and urban areas had the same number of participants. Out of 100 participants, the majority of participants, which is 56/100, had a score of 1 in adhesions, and among them, the majority of participants belonged to urban areas (table-4).

Table 5: Association between Stria gravidarum and various sociodemographic and obstetric factors

		Davy scoring for stria gravidarum				X2value	P value
		3-5 N=70	6 N = 20	7 N = 8	8 N = 2		
Area of living	**Rural**	21	4	4	1	2.86	0.563
	Urban	49	16	4	1		
Parity	**1**	56	18	6	2	2.79	1.000
	2	11	2	2	0		
	3	1	0	0	0		
	4	2	0	0	0		
No. of previous LSCS	**1**	59	19	6	2	6.70	0.350
	2	10	1	1	0		
	3	1	0	1	0		
Inter-pregnancy interval	**2-4 years**	53	16	7	2	1.83	0.935
	4-6 years	15	4	1	0		
	6-8 years	2	0	0	0		
Mode of LSCS	**Elective**	51	17	5	1	2.45	0.660
	Emergency	19	3	3	1		

There was an insignificant association between age, parity, number of previous cesareans, inter-pregnancy interval and mode of delivery with Davey's Scoring For Stria Gravidarum, thus with the change in age, parity, number of previous cesareans, inter-pregnancy interval and mode of delivery there is no change in the severity of strain gravidarum. ($P<0.05$)

Table 6: Association between Adhesions and Various sociodemographic and obstetric factors

		Modified Blauer classification for abdominal adhesion				X2value	P value
		Grade 0 N=12	Grade 1 N = 56	Grade 2 N = 27	Grade 3 N = 5		
Area of living	**Rural**	5	16	6	3	3.753	0.289
	Urban	7	40	21	2		
Parity	**1**	10	52	18	2	51.07	**<0.001***
	2	2	3	9	1		
	3	0	1	0	0		
	4	0	0	0	2		
No. Of prev LSCS	**1**	12	56	18	0	73.02	**<0.001***
	2	0	0	9	3		
	3	0	0	0	2		
Inter-pregnancy interval	**2-4 years**	9	41	25	3	13.01	**<0.001***
	4-6 years	3	14	2	1		
	6-8 years	0	1	0	1		
Mode of LSCS	**Elective**	8	42	21	3	1.07	0.783
	Emergency	4	14	6	2		

There was a significant association between parity, number of previous cesareans, inter-pregnancy interval and abdominal adhesions according to Modified Blaeur classification for abdominal adhesion; thus, with the increased parity, number of previous cesareans and inter-pregnancy interval, there is an increase in abdominal adhesions. **(P<0.001)**

Table 5: Correlation between striae gravidarum and adhesions

	Correlation	P value
Stria gravidarum and adhesions	-0.160	0.112

Thus, there is no correlation between the score of stria gravidarum and intra-abdominal adhesions.

Discussion:

Following one pregnancy, approximately 90% of women develop striae gravidarum (stretch marks), while over 90% experience incisional peripartum adhesions (IPA) of varying severity after a single caesarean section [10,11]. The presence of IPA may elevate the morbidity risk for women undergoing caesarean sections, contributing to challenges such as difficult entry, injuries to adjacent organs, and early postoperative obstruction, among many [12].

Predicting these occurrences in advance could enhance surgical preparedness for potential complications and assist women and their families in making informed decisions about the optimal surgical setting [13]. The potential connection between striae gravidarum and IPA has intrigued researchers.

The current study observed all females having SG, and 82% (n=82) of females had adhesions of varying severity. However, the current study did not reveal a significant association between the occurrence of striae gravidarum and incisional peripartum adhesions.

In this study, intraabdominal adhesions were classified using the Modified Blauer classification, similar to Dogan et al. and Celik et al. [6,14]. Other classifications utilized in similar studies are Modified Nair', Peritoneal Adhesion Index, and Site-specific adhesion scoring system [15-17]. However, we find the system employed to be easy to administer and evaluate.

Women with or without striae had the same amount of peritoneal adhesions, according to Elprince et al. [5]. However, a different study found that women with little or mild striae had greater rates of intraperitoneal adhesions than women with severe striae (67.3, 65.9, and 36.3%, respectively) [18]. However, the correlation between SG severity and intraabdominal adhesions remains uncertain.

Studies by Dogan et al. proposed an inverse relationship between SG and IPAs and Gungor et al. a linear one [14,19]. Celik et al. suggested that SG is more related to abdominal scar characteristics than intraabdominal adhesions, while Zainab AAJ et al. claimed that the type of striae may be more relevant than severity [2,6]. The transition of striae from rubra to alba may influence adhesion formation, although this association lacks sufficient sensitivity and specificity [20]. The findings of Madendag et al. indicate no significant difference in SG scores and peritoneal adhesions [13]. Similar conclusions were drawn by Bibi et al. and Celik et al., who found no compelling evidence of a notable relationship between SG scores and peritoneal adhesions [6,21].

Connecting both entities is overly simplistic due to their distinct risk factors. Striae gravidarum (SG) is influenced by genetic disparities and risk factors such as collagen quality, encompassing elements like younger age, higher BMI, hormonal changes, maternal and family history of SG, higher pre-pregnancy and pre-delivery weight, and elevated birth weight, as highlighted by [20]. On the contrary, intraperitoneal adhesion is shaped by diverse factors, including medical history, maternal characteristics, advanced age, postpartum infection, surgery type (clean contaminated or clean), laparotomy or laparoscopy, elective or emergent procedures, surgical skills, amount of intraperitoneal blood collection, suture type (powdered or non-powdered gloves), obesity or high BMI, diabetes mellitus, total time duration of the surgery, and various other variables [12,22].

Laparoscopic surgery has revolutionized our understanding of adhesion formation [23]. Minimally invasive surgeries are known to reduce factors such as tissue hypoxia, air exposure, or contamination with powdered gloves, resulting in decreased adhesion formation [12,22]. This paradigm shift highlights the importance of surgical techniques in influencing the development of intraperitoneal adhesions, which have no relation to striae gravidarum. Estrogen, known for its elastic properties, is implicated in developing striae gravidarum [24]. Interestingly, high doses of estrogen are prescribed post-hysteroscopic surgeries to prevent adhesion formation, particularly in cases of Ashermann's syndrome or transcervical resection of the endometrium (TCRE) [23].

The principle of tissue injury and tissue healing or fibrin deposition and fibrin degradation stays the same for SG as well as IPA. However, a disturbance in ROS [reactive oxygen species] production and elimination and adhesion fibroblast phenotype are unique to IPA formation [25,26]. The thinning of the epidermis, loss of dermal papillae, and alterations in the extracellular matrix characterize striae, whereas intraperitoneal adhesions involve the formation of new tissues between adjacent surfaces [14]. Simultaneous epithelialization of the entire peritoneal surface, while healing after surgery, is a distinctive appearance of IPA. In comparison, SG heals in the usual way of any wound, i.e. from the periphery.

Hence, we believe that they do share some common pathways, but multiple variables are at play and have significant effects [12,22].

Striae gravidarum (SG) starts appearing around 24 weeks of gestation and progresses through various maturation stages (i.e. striae alba and rubra) until term, differently in each individual [27]. However, adhesions are reported to start forming immediately following surgery. The strengthening and remodelling continue for one month or longer [12,13]. The concept of Early Recovery after Cesarean is in vogue so that adhesion formation can be reduced as much as possible [28].

The ongoing debate on whether peritoneum closure techniques are linked to adhesion formation has been explored extensively. Shiliro et al. advocated for peritoneal and/or rectus muscle closure during cesarean section (CS) as a safe practice to reduce adhesion formation [29]. In contrast, a systemic review by Bamigboye et al. involving 29 trials found no conclusive evidence associating adhesion formation with closure or non-closure techniques. Non-closure, in fact, was associated with shorter surgical times [30].

A number of previous surgeries, interpregnancy interval and higher parity were significantly associated with the severity of IPAs in our study. IPAs may lead to significant postoperative complications, posing a considerable burden on both the patient and the operating surgeon. The distinction is crucial as severe complications can result in legal, medical, and psychological implications for physicians, mothers, as well as families. SG, on the other hand, neither disfigures cosmetically with every passing pregnancy nor does the severity pose any significant morbidity threat to females [31]. However, an ultrasonographic sign of "sliding sign" is being evaluated to predict IPAs.

However, limitations exist in the study, including the absence of prior surgical notes for certain participants and limiting information on the specifics of previous surgeries. The small size of the study group and the strict criteria for participant selection also pose challenges, emphasizing the need for further research to establish clearer associations between SG and intraabdominal adhesions. The limited size of the study group was one of the primary limitations of the current investigation.

Conclusion:

The stria gravidarum does not correlate with the prediction of intra-abdominal adhesion in repeat caesarean sections. Multiple factors are involved in their etiopathogenesis, which are responsible for it.

References

1. Hesselman S, Högberg U, Råssjö EB, Schytt E, Löfgren M, Jonsson M. Abdominal adhesions in gynaecologic surgery after caesarean section: a longitudinal population-based register study. BJOG: An International Journal of Obstetrics & Gynaecology. 2018 Apr; 125(5):597-603.
2. Jaafar ZA, Obeid RZ, Salman DA. Skin markers and the prediction of intraabdominal adhesion during second Cesarean delivery. Ginekologia Polska. 2019; 90(6):325-30.
3. Rottenstreich M, Sela HY, Shen O, Michaelson-Cohen R, Samueloff A, Reichman O. Prolonged operative time of repeat cesarean is a risk marker for postoperative maternal complications. BMC pregnancy and childbirth. 2018 Dec; 18(1):1-6.
4. Neethi Mohan V, Shirisha P, Vaidyanathan G, et al. Variations in the prevalence of caesarean section deliveries in India between 2016 and 2021 – an analysis of Tamil Nadu and Chhattisgarh. BMC Pregnancy Childbirth. 2023; 23:622.
5. Elprince M, Taha OT, Ibrahim ZM, Khamees RE, Greash MA, Atwa KA et al. Prediction of intraperitoneal adhesions using striae gravidarum and scar characteristics in women undergoing repeated cesarean sections. BMC Pregnancy and Childbirth. 2021 Dec; 21(1):1-7.
6. Celik EY, Ersoy AO, Ersoy E, Yoruk O, Tokmak A, Tasci Y. Is striae gravidarum related to cesarean scar and peritoneal adhesions? Pakistan Journal of Medical Sciences. 2018 May; 34(3):568.
7. Kazmi T, Saiseema S 5th, Khan S. Analysis of Cesarean Section Rate - According to Robson's 10-group Classification. Oman Med J. 2012 Sep; 27(5):415-417.
8. Davey CM. Factors associated with the occurrence of striae gravidarum. The J Obstet Gynaecol Br Commonw. 1972; 79(12):1113-14.
9. Blauer KL, Collins RL. The effect of intraperitoneal progesterone on postoperative adhesion formation in rabbits. Fertil Steril. 1988; 49(1):144-49.
10. Osman H, Rubeiz N, Tamim H, Nassar AH. Risk factors for the development of striae gravidarum. Am J Obstet Gynecol. 2007 Jan; 196(1):62.e1-5.
11. Watson REB. Stretching the point: an association between the occurrence of Striae and pelvic relaxation? J Investig Dermatol. 2006; 126(8):1688–9.
12. Lyell DJ. Adhesions and perioperative complications of repeat cesarean delivery. American journal of obstetrics and gynaecology. 2011 Dec 1; 205(6):S11-8.

13. Çöl Madendağ I, Şahin Eraslan M.The assessment of the prediction capacity of abdominal striae gravidarum on intraabdominal adhesions in pregnant women with a history of cesarean section was evaluated before the cesarean section. Perinatal Journal 2019; 27(3):150-154.
14. Dogan A, Ertas IE, Uyar I, Karaca I, Bozgeyik B, Töz E, Ozeren M. Preoperative Association of Abdominal Striae Gravidarum with Intraabdominal Adhesions in Pregnant Women with a History of Previous Cesarean Section: a cross-sectional study. Geburtshilfe Frauenheilkd. 2016; 76(3):268- 272.
15. Nair SK, Bhat IK, Aurora AL. Role of proteolytic enzyme in the prevention of postoperative intraperitoneal adhesions. Arch Surg. 1974 Jun; 108(6):849-53.
16. Coccolini, F., Ansaloni, L., Manfredi, R. et al. Peritoneal adhesion index (PAI): proposal of a score for the "ignored iceberg" of medicine and surgery. World J Emerg Surg 2013; 8:6.
17. Tulandi, T., Lyell, D.J. Classification of intra-abdominal adhesions after cesarean delivery. Gynecol Surg 2013; 10, 25–29.
18. Watson RE, Parry EJ, Humphries JD, et al. Fibrillin microfibrils are reduced in skin exhibiting striae distensae. Br J Dermatol. 1998; 138(6):931–7.
19. Gungor ANC, Oguz S, Hacivelioglu S, Isik S, Uysal A, Gencer M, et al. Predictive value of striae gravidarum severity for intraperitoneal adhesions or uterine scar healing in patients with previous caesarean delivery. J MaternalFetal Neonatal Med.2013; 27(13):1312-5.
20. Farahnik B, Park K, Kroumpouzos G, et al. Striae gravidarum: Risk factors, prevention, and management. Int J Womens Dermatol. 2017; 3(2): 77–85.
21. Bibi I, Majeed S, Hussain HN. Relation of striae gravidarum with cesarean scarand peritoneal adhesions. J Med Physiol Biophysics. 2018; 49:107-12.
22. Practice Committee of American Society for Reproductive Medicine in collaboration with Society of Reproductive Surgeons. Pathogenesis, consequences, and control of peritoneal adhesions in gynecologic surgery: a committee opinion. Fertil Steril. 2013 May; 99(6):1550-5.
23. Yang L, Ma N, Song D, Huang X, Zhou Q, Guo Y, Xia E, Shi X, Li TC. The effect of estrogen in the prevention of adhesion reformation after hysteroscopic adhesiolysis: a prospective randomized control trial. Journal of Minimally Invasive Gynecology. 2022 Jul 1; 29(7):871-8.
24. Ren P, Zhao W, Dai X, Wang X, Yu J, Yuan Y, Wu Y. Risk factors for the formation of striae gravidarum in women in Jiangsu Province of China. Taiwanese Journal of Obstetrics and Gynecology. 2019 Sep 1;58(5):640-4.
25. Saed GM, Diamond MP. Molecular characterization of postoperative adhesions: the adhesion phenotype. J Am Assoc Gynecol Laparosc. 2004;11(3):307–314
26. Awonuga AO, Fletcher NM, Saed GM, Diamond MP. Postoperative adhesion development following cesarean and open intra-abdominal gynaecological operations: a review. Reprod Sci. 2011 Dec; 18(12):1166-85.
27. González-Quintero VH, Cruz-Pachano FE. Preventing adhesions in obstetric and gynecologic surgical procedures. Rev Obstet Gynecol. 2009 Winter; 2(1):38-45.
28. Scott MJ, Baldini G, Fearon KC, Feldheiser A, Feldman LS, Gan TJ, Ljungqvist O, Lobo DN, Rockall TA, Schricker T, Carli F. Enhanced Recovery After Surgery (ERAS) for gastrointestinal surgery, part 1: pathophysiological considerations. Acta Anaesthesiol Scand. 2015 Nov; 59(10):1212-31.
29. Schiliro A, Muscat J, Calixte R, Han T, Vintzileos A. 515: Factors influencing adhesion formation after primary cesarean delivery. American Journal of Obstetrics & Gynecology. 2016 Jan 1; 214(1):S279-80.
30. Bamigboye AA, Hofmeyr GJ. Closure versus non-closure of the peritoneum at caesarean section: short- and long-term outcomes. Cochrane Database Syst Rev. 2014 Aug 11; 2014(8):CD000163.
31. Brennan M, Clarke M, Devane D. The use of anti-stretch marks' products by women in pregnancy: a descriptive, cross-sectional survey. BMC pregnancy and childbirth. 2016 Dec; 16(1):1-0.