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Surgery

ASSSESMENT OF MODIFIABLE RISK FACTORS OF SURGICAL SITE INFECTION

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ABSTRACT Understanding the risks and risk factors to health are key to preventing diseases.The study was done to assess modifiable risk factors for surgical site infection (SSI).It included 450 women who had undergone caesarean section.Various modifiable risk factors were evaluated and data of women with SSI was compared with that of women who did not develop SSI. Women with obesity, anaemia, hypertension, diabetes and hypothyroidism along with poor or irregular antenatal care had high odds ratio for developing SSI.Hence ,careful and timely modifications of these risk factors can improve the maternal outcome and decrease the postoperative morbidity.

KEYWORDS : diabetes, hypertension, obesity, surgical site infection

INTRODUCTION

A study of diseases and the risk factors that cause them is vital for health decision making and planning.Most scientific and health resources go towards treatment. However, understanding the risk factors to health are key to preventing diseases.[1]

Risk factors may be non-modifiable,which include a person's age, ethnicity and family history among other factors. The modifiable disease risk factors are those that can be reduced or controlled with altered behavior.[2]

The 2009 World Health Organization report on global health risks identified hypertension, smoking, raised glucose, physical inactivity, obesity and dyslipidemia, in that order, as being the top six modifiable global mortality risk factors.[3]

Surgical site infection (SSI) is one of the most common complication of any surgery, resulting in significant burden in terms of morbidity and length of hospital stay. Multiple risk factors for SSI have been identified. Some of these factors directly affect the wound-healing process, others can lead to blood-borne sepsis or relative immunosuppression.[4] Modifying a patient's medications, screening for comorbidities, such as hypertension,obesity or diabetes mellitus could lower the risk for SSI.

The objective of the study was to identify potentially modifiable risk factors of SSI after caesarean section,to help in reduction of overall SSI rates.

METHOD

The study was conducted on 450 women undergoing caesarean section.After a detailed history and clinical examination, caesarean section was performed.Based on the presence or absence of postoperative SSI, they were categorised in two groups.Modifiable risk factors were evaluated and data of women with SSI was compared with that of women who did not develop SSI.

RESULTS

Fifty women out of 450 had SSI (11.11%).

In our study, 66% of women with SSI had BMI $\geq$ 25 as compared to 35.5% women with no SSI had BMI $\geq$ 25. As compared to women with < 25 BMI, as the BMI increased the risk of SSI in terms of odds ratio increased, from 3.06 in those with BMI 25-29.9 to 25.29 in those with BMI $\geq$ 30. (p = 0.0001).

Majority of the non anaemic women did not develop SSI. 20% women developed SSI were anaemic as compared to 7.5% women with no SSI.Women with anaemia (odds ratio-3.08) were at more risk of SSI. In the study, statistically significant association found between haemoglobin level and SSI (p = 0.003).

Table 1.Association of SSI with Obesity and Anaemia

		Women with SSI (n=50)	Women with no SSI (n=400)	Adjusted odds ratio (AOR)	
BMI (kg/m2)	18.5-24.9	17(6.2%)	258 (93.8%)	1	Chi-square = 33.56 with DOF = 2 p = 0.0001 (S)
	25-29.9	28(16.8%)	139 (83.2%)	3.06(1.62-5.78)	
	>30	5(62.5%)	3 (37.5%)	25.29 (5.57-114.87)	
Hb (gm/dl)	7.0-9.0	10(25%)	30(75%)	3.08 (1.40-6.77)	Chi-square = 8.575 with DOF 1 p = 0.003 (S) p = 0.003 (S)
	9.1-13.0	40(9.7%)	370(90.3%)	1	

Hypertension was found in 17.11% women. 26% women with SSI were hypertensive as compared to 13.5% women with no SSI had hypertension.As compared to controlled hypertensives (odds ratio=0.76), uncontrolled hypertensives showed higher odds ratio (18.16) for SSI. So women who had uncontrolled hypertension were at higher risk for SSI.In the study, hypertension was found statistically highly significant associated risk factor for SSI (p = 0.0001).

7.77% women were diabetic. 10% Women with SSI had diabetes as compared to 7.5% women with no SSI, but the sugar levels of those with no SSI were controlled by medical nutritional therapy or were on insulin therapy and were euglycaemic most of the times.Women with GDM had higher odds ratio (1.43) for SSI compared with women who had overt diabetes (odds ratio=1.17).

Hypothyroidism was found in 18.44% and euthyroidism present in 81.56% women. 22% women having SSI were presented with hypothyroidism,in our study.Women with hypothyroidism had higher (odds ratio= 1.29) for SSI as compared with women with euthyroidism.

Table 2.Association of SSI with Medical diseases

Medical Diseases		Women with SSI (n=50)	Women with no SSI (n=400)	Adjusted odds ratio (AOR)	
Blood Pressure	Normal	37(9.9%)	336(90.1%)	1	Chi-square = 38.80 with DOF = 2 p = 0.0001 (S) p = 0.0001 (S)
	Controlled hypertensive	5(7.7%)	60(92.3%)	0.76 (0.29-2.00)	
	Uncontrolled hypertensive	8(66.7%)	4(33.3%)	18.16 (5.21-63.22)	
Blood Sugar	GDM	4(14.8%)	23(85.2%)	1.43 (0.47-4.32)	Chi-square = 0.421 with DOF = 2 p = 0.81 (NS)
	Overt diabetic	1(12.5%)	7(87.5%)	1.17 (0.14-9.77)	
	Euglycaemic	45(10.8 %)	370(89.2%)	1	
Thyroid levels	Normal	39(10.6 %)	328(89.4%)	1	Chi-square = 0.473 with DOF = 1 p = 0.491 (NS)
	Hypo-thyroidism	11(13.3 %)	72(86.7%)	1.29 (0.63-2.63)	

In our study, higher number of SSI was seen in women who never attended the antenatal clinic as compared to SSI in women who had three or more antenatal clinic visits.Among the 50 women with SSI, 40% had no visits.Among women with no SSI, 55% women had 3 or more than 3 visits.Women with no antenatal visit had higher odds ratio (3.94) as compared to women with 1 or 2 antenatal visits (odds ratio= 1.77). Analysis of the antenatal clinic visits of women showed that the odds ratio was high if number of visits were less. So less antenatal visits showed a statistically significant association with risk of SSI (p = 0.003).

Table 3.Association of SSI with Antenatal Visits

ANC visits	Women with SSI (n=50)	Women with no SSI (n=400)	Adjusted Odds ratio (AOR)	
Nil	20 (22.2%)	70(77.8%)	3.94 (1.94-8.03)	Chi-square = 15.82
<3	14 (11.4%)	109(88.6%)	1.77 (0.84-3.77)	with DOF= 2 ,p = 0.003 (S)
>3	16 (6.8%)	221(93.2%)	1	p =0.003(S)

DISCUSSION

The various modifiable risk factors of SSI were analysed.Obesity was a highly significant associated risk factor for SSI. Dr Meenu et al (2020)[5], Novelia S et al (2017)[6] also observed that BMI >27kg/m^2 was a risk factor for SSI.

Obese patients have tissue hypoperfusion which predispose to SSI through a greater risk of ischaemia and necrosis.In addition, surgery on obese women could be more complex and prolonged and prolonged procedure itself is an independent risk factor for SSI.[6] Women with obesity have limited mobility,which might disturb blood circulation and influence the wound healing process. However, there might be opportunities to tackle obesity by targeting dietary advice in early pregnancy or preconception.

Women with anaemia had odds ratio-3.08 for SSI. Getaneh T et al (2020)[7], Molla M et al (2019) [8] identified anaemia as a risk medical factor as mothers with anaemia had OR=4.56 and 5.28, respectively as compared to women with Hb greater than 11 gm %.

Low iron level alters the function of host immune system. In addition, low haemoglobin level causes lower oxygen saturation at peripheral tissue causing delay in wound healing and high risk of developing SSI.[7] Correction of anaemia preconceptionally or during pregnancy as soon as diagnosed can help prevent the infection.

As compared to controlled hypertensives (odds ratio=0.76), uncontrolled hypertensives showed higher odds ratio (18.16) for SSI. So women who had uncontrolled hypertension were at higher risk for SSI.

There is hypo-perfusion of the wound caused by peripheral vasoconstriction effect of PIH.[9] Oedematous wound edges may allow entry of organisms and establishment of infection. Keeping blood pressure under control can prevent the effect due to hypertension on surgical site .

In our study, 7.77% women were diabetic. 10% Women with SSI had diabetes as compared to 7.5% women with no SSI, but the sugar levels of those with no SSI were controlled by medical nutritional therapy or were on insulin therapy and were euglycaemic most of the times.Women with GDM had higher odds ratio (1.43) for SSI compared with women who had overt diabetes (odds ratio=1.17). Although in our study, we did not found statistically significant association between diabetes and SSI (p = 0.81), which was consistent with findings of various similar studies in the past.[5,10]

Vallejo MC et al also observed that pre-existing diabetes mellitus was not an independent risk factor for SSI, conversely gestational diabetes was a significant factor. This may be due to the lack of adequate blood sugar control and similar awareness in pregnant patients recently diagnosed with gestational diabetes. There was decreased fibrogenesis, macrophage response, and angiogenesis, leading to delayed closure, wound breakdown, and infection.[10] Diabetes also causes vasoconstriction and affects tissue circulation leading to local tissue hypoxia. Further, micro vascular changes that result from sustained hyperglycaemia may lead to impaired tissue oxygenation.[6] Poorly controlled diabetes results in advanced glycosylation end products, with impairment of the host immune response and decreased reepithelialization of wounds.[11]As shown in our study too,well controlled sugar levels can keep the risk factor under control.

Women with hypothyroidism had higher odds ratio= 1.29 for SSI as compared with women with euthyroidism.Patients with hypothyroidism show slower drug metabolism and are exposed to the risk of an overdose of anaesthetic and other medications used during the surgical treatment.Keeping TSH levels in normal range can prevent the effect due to hypothyroidism on the surgical site .

In our study, women with no antenatal visit had higher odds ratio (3.94) as compared to women with 1 or 2 antenatal visits (odds ratio= 1.77). Amenu et al 2011)[12] also observed that the majority of the women were from rural areas and had no antenatal visits. It could be that because these women,who had fewer or nil antenatal visits,may be anaemic, with uncontrolled diabetes or uncontrolled hypertension, hypothyroidism.They may present with postdated pregnancy or prolonged rupture of membranes, prolonged labour. These all may have led to higher SSI in these women.

Therefore, antenatal clinics should be strengthened in the rural areas,so as to detect risk factors early and timely referral to decrease pregnancy complications with increased emergency obstetric care services.[12]

CONCLUSION

Understanding , modifying and keeping under control the risk factors to SSI, like obesity, anaemia, hypertension, diabetes and hypothyroidism along with regular antenatal care are key to preventing the infection, thereby decreasing the morbidity related to it in caesarean women.

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