Original Article

Surgical Site Wound Infection Following Caesarian Section at Ad-din Women's Medical College and Hospital, Dhaka: Rates and Microbiological Profile

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Abstract:

Background: Surgical site infection (SSI) occurs within 30 days of post-surgical procedure involving skin, subcutaneous tissue, soft tissue or any other parts of anatomy. According to the CDC. SSI is a significant cause of post-surgical morbidity and mortality. The objectives of this study were to determine the occurrence, the risk factors for infection following caesarean section (C/S) and to analyze its microbiological pattern.

Method: This prospective hospital-based study was conducted at the OBG Dept. of Ad-din Women's Medical College and Hospital. Dhaka, from 6 months period (January to June 2021). Total 5199 caesarean sections were performed at the OBG, AWMCH among women who developed surgical site infections (SSI) within 30 days of CS performed. Suspected SSIs were confirmed clinically by the surgeon, attested, by bacteriological culture.

Results: Of 5199 caesarean deliveries, 136 cases developed SSI (2.6%). The highest incidence of SSI was documented among women aged 20-30 years (63.2%), of who 54.4% were multiparous. The majority women were originally from rural areas (5 1.5%) women, 76.5% of women which were due to not attending for an antenatal care (ANC) checkup. Of them 90 cases (66.2%) belonged to middle class family. The incidence of infection was higher in obese women (47.8%) having BM1 > 30. and 33% in those with a BMI of 25-29.9. Of all associated comorbidities Premature Rupture of Membranes (PROM) were 25%, Gestational Diabetes Mellitus (GDM) in 14.7%, anemia in 14.7% and Gestational hypertension (GHTN) in 1 1%. Majority emergency caesarean deliveries 77.9% cases. Of total 52.2% cases had prolonged operation. On bacteriological culture growth. 26% which were *S. aureus,* followed by 25% *P. Aeruginosa,* 12.5% *S. Epidermis's* and 1 1.5% *E. coli*. However, 60 cases (44.1%) revealed as Multi-drug Resistant (MDR).

Conclusion : Surgical site infection in patients of caesarean delivery may be reduced by maintaining a normal BMI, ensuring proper and regular ANC to identify and treat comorbidities, limiting the preoperative hospital stay, improving surgeon's operative skill and technique and to reduce the operating duration and also informing the patients about the risk of SSI associated with elective C/S.

Key words: Body mass index, Caesarean Section, Hospital Stay, Hypertension, Diabetes Mellitus, Surgical Site Infection. Gestational Hypertension, Gestational Diabetes Mellitus.

Introduction:

The caesarean section (CS) is one of the most common obstetrical surgical procedures. It is performed when clinically indicated to facilitate delivery in complicated cases, hence prevents maternal and perinatal morbidity and mortality.[1]

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Among surgical complications, surgical site infection (SSI) rates range from 3-15% worldwide[2-4] and is defined as the infection which occurs within 30 days of post-surgical procedure involving skin, subcutaneous tissue, soft tissue or any other part of the anatomy, according to the Centers for Disease Control and Prevention (CDC).[5] Surgical site infection (SSI) following caesarean section is a major cause of morbidity and mortality, increasing both the duration of hospitalization and hospital cost.[6-9]

To reduce this complication, it is imperative to identify the risk factors and manage these factors. Multiple factors are related to SSI. Host related factors include- maternal age, obesity, personal hygiene, and immune-compromised status, presence of other medical comorbidities like hypertension, Diabetes Mellitus, anaemia, premature rupture of membrane (PROM), prolonged labor, and previous surgeries. Some procedural factors include- preoperative preparation, duration of surgery, the skill of operating surgeon, the type of suture material used and the prophylactic use of antibiotics.

The objectives of this study were to determine the incidence, & other factors for infection following caesarean section and to analyze its microbiological pattern.

Materials and methods:

The study was conducted at Ad-din Women's Medical College and Hospital (AWMCH), Dhaka, which is a 700 bed facility with multiple medical and surgical specialties, including Obstetrics and Gynecology. The study period was from January 2021 to June 2021. The data were collected from the post-operative ward, on a day to day basis and the risk factor profile was analyzed for those patients who had developed SSI following their caesarean delivery at the AWMCH.

Patients with SSI were identified as per the following criteria:

1. Infection occurring in the first post- operative week (Within 30days>)
2. Involving skin and subcutaneous tissue at surgical site with any one of the following :
    a. Purulent discharge.
    b. Organism isolated from fluid / tissues of superficial incision.
    c. At least one sign of inflammation (indurations/ erythema/local rise of temperature).
    d. Wound deliberately opened by the surgeon for drainage.
    e. Surgeon declares that the wound is infected.

The Exclusion Criteria is as follows:

1. Patients who required obstetric hysterectomy or had any other surgical complication
2. Caesarean deliveries that were not performed at the AWMCH.

Patients presenting with the symptoms and signs of wound infection following caesarean delivery were identified as per the CDC (Centers for Disease Control and Prevention) definition and criteria. As part of the risk factor profile analysis, patients' maternal age, parity, socio-economic class, area of residence, Body Mass Index (BMI), Antenatal care (ANC) attendance was recorded and patients were also assessed for hypertensive disorders, diabetes mellitus, anemia, hypothyroidism, bronchial asthma, etc. These aforementioned factors may contribute as the socio-demographic and obstetric risk factors along with the particulars of the surgery and labor pain. Details of the microbiological profile and antibiotic sensitivity were recorded from the wound culture and sensitivity reports.

Statistical analysis:

Out of 5199 caesarean deliveries, 136 patients met the inclusion criteria for SSI and were sampled in this study. The occurrence of surgical site infections were documented in percentage, and its distribution among the socio-demographic factors, associated comorbidities, type of caesarean section, surgery duration, and wound culture reports, was tabulated.

Result:

A total of 5199 pregnant women underwent caesarean section during the study period. Out of these, 136 were documented cases of SSI and this puts the incidence of SSI in AWMCH at 2.6%.

The following observations were noted in our study:

Table I

Distribution of surgical site infection among maternal socio-demographic obstetric characteristics

Variables	No. of Patients (n=136)	Incidence of SSI (%)
Age Range		
Less than 20 years	18	13.2%
20-30 years	86	63.2%
Years	22	16.2%
>35 years	10	7.4%
Parity		
Nulliparous	62	45.6%
Multiparous	74	54.4%
Location of Residence		
Rural	70	51.5%
Urban	66	48.5%
ANC attendance		
Regular	32	23.5%
Irregular	54	39.7%
Did not attend	50	36.8%
Socioeconomic status		
Lower	34	25%
Middle	90	66.2%
Higher	12	8.8%
Body Mass Index		
18.5-24.9 (Normal wt.)	26	19.1%
25-29.9 (Overweight)	45	33%
≥ 30 (Obese)	65	47.8%

Table I shows that the highest incidence of SSI was documented in women aged 20-30 years (63.2%), and 54.4% of multiparous women developed SSI. The majority were originally from rural areas (51.5%). A large number of patients did not have regular ANC attendance, 39.7% of which had irregular antenatal care (ANC) attendance, or not undergone any antenatal checkup at all (36.8%). of them 90 cases (66.2%) belonged to a middle class family. Their Body Mass Index (BMI) typically fell within the range of 18.5 to 24.9, but of 47.8% who had infection had a BMI of ≥ 30, and other 33% had a BMI of 25-29.9.

Table II

Prevalence of co- morbidities among patients with SSI

Associated Comorbidity	Number of of SSI (n=136)	Incidence (%)
Hypertensive disorder	15	11%
Eclampsia	5	3.7%
Gestational diabetes mellitus (GDM)	20	14.7%
Bronchial asthma	6	4.4%
Hypothyroidism	8	5.9%
Anaemia	20	14.7%
Premature Rupture of Membranes (PROM)	34	25%
PROM < 6 hours	25	18.4
PROM >6 hours	9	6.6
Urinary Tract Infection (UTI)	6	4.4%
IUFD (Intrauterine fetal death)	4	2.9%
Other (Obstetric cholestasis/ Hepatitis/Cholecystitis)	8	5.9%
No known comorbidities	10	7.4%

Table-II showed that, among 136 patients, 34 had suffered from PROM (25%), 20 had GDM (14.7%), 20 were anemic (14.7%), 15 had GHTN (11%). Only 7.4% of infected patients had no known comorbidities.

On analyzing the particulars of surgery, it was determined that emergency deliveries accounted for 106 cases (77.9%), and the frequency of SSI escalated with surgeries exceeding of a duration of 45 minutes (52.2%). (Table-III)

Table III

Relation between particulars of the surgery and incidence of SSI

Type of caesarean section	Number of Patients (n=136)	Incidence of SSI (%)
Emergency	106	77.9%
Elective	30	22.1%
Duration of surgery		
30-45 minutes	65	47.8%
>45 minutes	71	52.2%

Table IV

Relation between the labor status and number of per vaginal examinations (PVEs) and incidence of SSI.

Duration of labor pain	Number of Patients (n=136)	Incidence of SSI (%)
< 6 hours	15	11%
>6 hours	35	25.7%
6-12 hours	19	14%
Number of PVEs before CS		
< 3	29	21.3%
> 3	40	29.4%
Was not in labor	67	49.3%

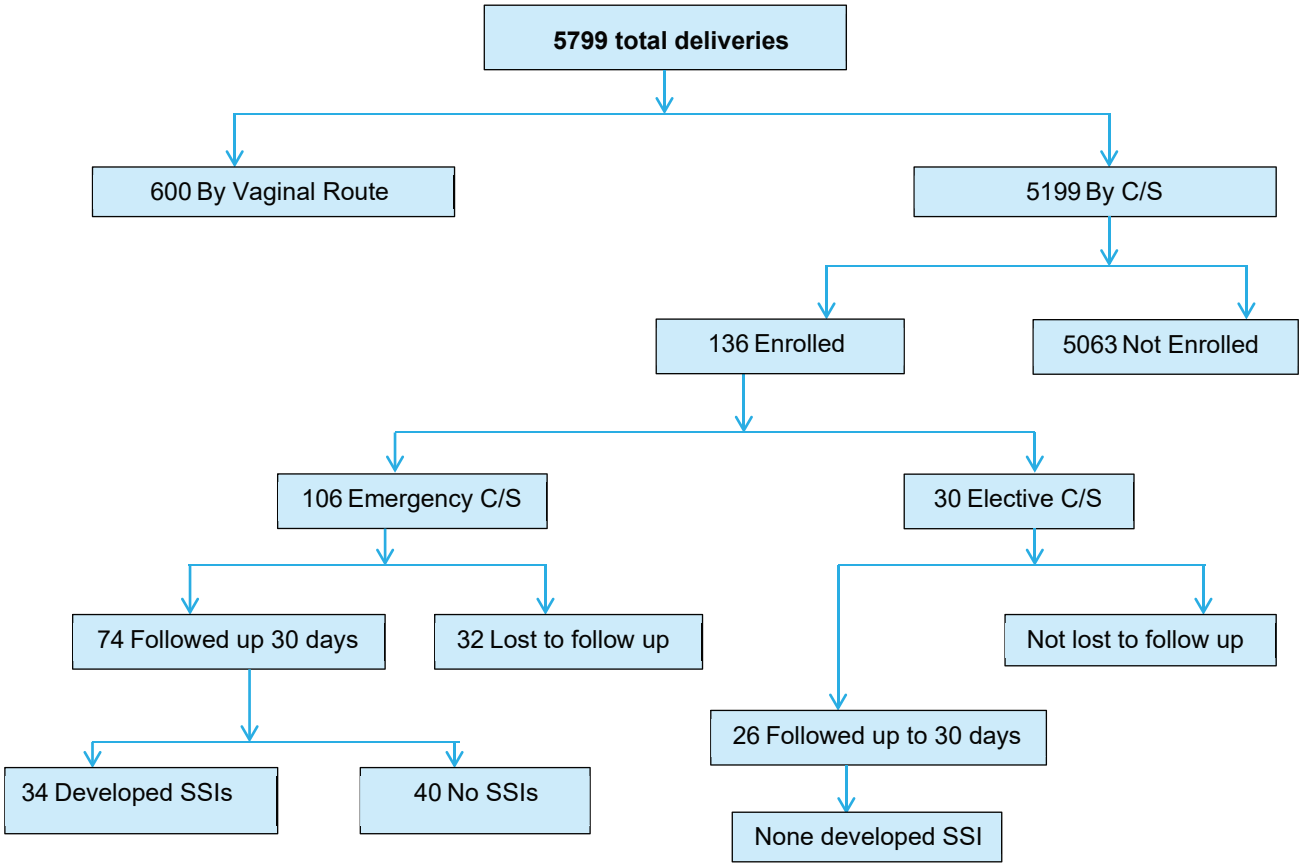
Of 69 patients who had labor pain (51%), 54 had labor pain for more than 6 hours (39.7%). We observed that repeated >3 PVE had been performed on 29.4% of patients who developed SSI. (Table-IV)

Table V

Microbiological characteristics of infected patient

Days to infection	No. of Patients (n=136)	Incidence of SSI (%)
< 15 days	102	75%
≥ 15 days	34	25%
Nature of the wound discharge		
Purulent	48	35.3%
Bloody	30	22.1%
Serous	58	43%
Wound culture		
Positive growth	96	70.6%
No growth	40	29.4%
No MDRO (Multidrug resistant organism)	76	55.9%
MDRO	60	44.1%
Organism detected		
Staphylococcus aureus	25	26%
Pseudomonas Aeurigonsa	24	25%
Staphylococcus epidermidis	12	12.5%
Actinobacter	10	10.4%
E.Coli	11	11.5%
Proteus	6	6.3%
Diphtheroid	5	5.2%
Nocardia	3	3.1%

Flowchart:



Among the 136 SSI cases, 102 developed infection within 15 days post-operatively (75%), 43% had serous discharge, while pus was present in wounds of 35.3% cases. Out of 136 wound swabs collected, 70.6% (96 cases) showed a growth of an organism, while 29.4% did not. Multidrug resistant organisms (MDRO) were found in 60 cases (44.1%). Among the 96 cases, 26% yielded growth staphylococcus aurous 25% pseudomonas aeruginosa 12.5% S. epidermidis 10.4% Actinobacter, 11.5% E.Coli, 6.3% Proteus, 5.2% Diphtheria and 3.1% Nocardia (Table-V).

Discussion:

As per the National Nosocomial Infection Surveillance (NNIS) system, SSI (surgical site infection) is the second most common post-operative infection following caesarean deliveries, with an incidence ranging from 3 to 15%. In India, as per a study conducted at Lady Hardinge Medical College New Delhi, the infection rate was 24.2%. In a study showed that, at a tertiary care center, Tamkur in Karnataka, the SSI rate following a lower segment caesarean section (LSCS) was 16%.[10] In our study, the incidence of SSI was 2.6%.

Multiple factors have been shown to contribute to post –CS SSI. In our study, the majority of cases, 76.8% of SSI, were above 20 years of age. This was similar to studies conducted by Anjum and Wloch C, et al (2012), while a study in Nigeria showed 75% SSI cases were below 25 years of age, replicating the outcomes of a study in rural India.[11-14] In our present study, we observed a high incidence of SSI in with a BMI of ≥ 30 (47.5%). Similar results were found in other studies. (BMI >35kg/m,[10-12] multiparty was found to be a major factor in our study.[15,16] Majority of our patients were multiparous, and a large number of patients had no antenatal checkup or had it irregularly. Majority of the patients when developed SSI belonged tomiddle class families.

Patients with pre-existing illness, such as anemia, hypertensive disorders, and diabetes mellitus were seen to be more prone to yield infection. It is generally agreed

that anemia diminishes resistance to infection and is frequently associated with puerperal sepsis. Pre-operative anemia is an important predictor of infection as provedm in several other studies.[17, 18] Hypertensive disorders were present in 14.7% of our cases. Hypertension, pre-existing or pregnancy induced, and related comorbid states have been associated with SSI in several studies.[19-21] Hyperglycemia has several deleterious effects on host immune function, most notably on neutrophil function. Poor control of glucose during surgery and in the perioperative period increases the risk of infection. The disease state, inductions, hypo-albuminuria, edema-all can contribute to the development of SSI. A high proportion of SSI (25.5%) has been reported in emergency CS when compared to the 7.6% in elective cases[22], in our study. Asthma and hypothyroidism also predisposed to wound infection in our study.

A study conducted at Bugando medical center, showed repeated per vaginal examinations was a risk for post cesarean section surgical site infection; this study show that, women who had 3 or more PVEs were more likely to develop post cesarean section surgical site infection as compared with the counterparts who have less than 3.[22] This may be due to ascending infection to the surgical site.

Longer durations of surgery, exceeding more than 45 minutes, carried a significant association in our study. A study revealed that an operative period longer than the 75th percentile increased the risk of SSI by 1.84times, [24] with the probable etiologies for this increased SSI risk being: complicated surgery, inadequate tissue concentration of antibiotic, tissue trauma, breach of sterile technique, increased blood loss and prolonged exposure to environmental pathogens.

Wound infections represent the most common nosocomial infections in patients who underwent surgery and are often caused by a limited range of opportunistic pathogens.[23-25] In our study, 96 cases (70.6%) yielded microbial growth. Among which, 26% showed growth of Staphylococcus aureus, the other organisms isolated included Pseudomonas Aeruginosa (25%), S. epidermidis (12.5%), Actinobacter (10.4%), E.Coli (11.5%), Proteus (6.3%), Diphtheroid (5.2%) and Nocardia (3.1%). Multidrug resistant organisms (MDRO) were found in 60 cases (44.1%).

Preoperative hospital stay significantly increased SSI in this study. The stay in hospital premises increases patient susceptibility to hospital acquired infection. These infections increase the chance of puerperal sepsis and wound infection in these patients.

Women opting for a caesarean section for non-medical reasons should be discouraged and informed of the risks of SSI as a complication. For reducing the prevalence of SSI following CS we should take measures in the pre-, intra- and post- operative phases. In the preoperative phase, maintenance of a patient's personal hygiene, antibiotic prophylaxis and proper antiseptic preparation of the surgical site and the use of sterilized instruments all contribute to suppressing postoperative infection.

Conclusion:

By maintaining a normal BMI, ensuring proper and regular ANC attendance to identify and treat any comorbidities, limiting the preoperative hospital stay, improving surgeon operative skill and technique to reduce the operating duration, informing about the risk of SSI associated with elective cesarean section, we may be able to reduce SSI in patients of caesarean delivery.

In view of the increasing rates of CS being performed without a clear medical indication, new practice protocols should be implemented to reduce the rate of caesarean deliveries as a CS surgery has a 5-20 times higher risk of postpartum infection as compared to vaginal deliveries. Surgical site infections has increased the morbidity significantly in the postoperative period, thus requiring a prolonged hospital stay and surgical intervention. Multiple factors are responsible for SSI. Identification of risk factors should be done and management accordingly is one of the preventable measures to reduce SSI. Emergency CS and improper antibiotic prophylaxis are important risk factors in the development of SSI, and given the proliferation of multidrug resistant organisms. To reduce the infection rate, we should implement a revised prophylactic antibiotic policy.

References:

1. Charoenboon C, Srisupundit K, Tongsong T. Rise in cesarean section rate over a 20-year period in a public sector hospital in northern Thailand. Archives of gynecology and obstetrics. 2013 Jan;287:47-52.
2. Olsen MA, Butler AM, Willers DM, Devkota P, Gross GA, Fraser VJ. Risk factors for surgical site infection after low transverse cesarean section. Infection Control & Hospital Epidemiology. 2008 Jun;29(6): 477-84.

3. Schneid-Kofman N, Sheiner E, Levy A, Holcberg G. Risk factors for wound infection following cesarean deliveries. International Journal of Gynecology & Obstetrics. 2005 Jul 1;90(1):10-5.

4. Opøien HK, Valbø A, GRINDE-ANDERSEN AN, Walberg M. Post-cesarean surgical site infections according to CDC standards: rates and risk factors. A prospective cohort study. Acta obstetricia et gynecologica Scandinavica. 2007 Sep;86(9):1097 -102.

5. Anderson DJ. Surgical site infections. Infectious Disease Clinics. 2011 Mar 1;25(1):135-53.

6. Oliveira AC, Ciosak SI. Infection of surgical site in the following postdischarge: impact in the incidence and evaluation of the used methods. Revista da Escola de Enfermagem da USP. 2004;38:379-85.

7. Cooper NJ, Sutton AJ, Abrams KR. Decision analytical economic modelling within a Bayesian framework: application to prophylactic antibiotics use for caesarean section. Statistical methods in medical research. 2002 Dec;11(6):491-512.

8. Olsen MA, Butler AM, Willers DM, Devkota P, Gross GA, Fraser VJ. Risk factors for surgical site infection after low transverse cesarean section. Infection Control & Hospital Epidemiology. 2008 Jun;29(6):477-84.

9. McKibben L, Horan T, Tokars JI, Fowler G, Cardo DM, Pearson ML, Brennan PJ, Healthcare Infection Control Practices Advisory Committee. Guidance on public reporting of healthcare-associated infections: recommendations of the Healthcare Infection Control Practices Advisory Committee. American journal of infection control. 2005 May 1;33(4):217-26.

10. Anjum W, Abrar N. A Study on Surgical Site Infections (SSI) and associated factors in a Tertiary care Hospital in Tumkur, Karnataka. National Journal of Research in Community Medicine 2017;6(3):206- 12

11. Al Jama FE. Risk factors for wound infection after lower segment cesarean section. Qatar medical journal. 2013 Dec 1;2012(2):9.

12. Wloch C, Wilson J, Lamagni T, Harrington P, Charlett A, Sheridan E. Risk factors for surgical site infection following caesarean section in England: results from a multicentre cohort study. BJOG: An International Journal of Obstetrics & Gynaecology. 2012 Oct;119(11):1324-33.

13. Ezechi OC, Edet A, Akinlade H, Gab-Okafor CV, Herbertson E. Incidence and risk factors for caesarean wound infection in Lagos Nigeria. BMC research notes. 2009 Dec;2(1):1-5.

14. Pathak A, Mahadik K, Swami MB, Roy PK, Sharma M, Mahadik VK, Lundborg CS. Incidence and risk factors for surgical site infections in obstetric and gynecological surgeries from a teaching hospital in rural India. Antimicrobial Resistance & Infection Control. 2017 Dec;6:1-8.

15. Dhar H, Al-Busaidi I, Rathi B, Nimre EA, Sachdeva V, Hamdi I. A study of post-caesarean section wound infections in a regional referral hospital, Oman. Sultan Qaboos University Medical Journal. 2014 May;14(2):e211.

16. Mpogoro FJ, Mshana SE, Mirambo MM, Kidenya BR, Gumodoka B, Imirzalioglu C. Incidence and predictors of surgical site infections following caesarean sections at Bugando Medical Centre, Mwanza, Tanzania. Antimicrobial resistance and infection control. 2014 Dec 1;3(1):25.

17. Waisbren E, Rosen H, Bader AM, Lipsitz SR, Rogers Jr SO, Eriksson E. Percent body fat and prediction of surgical site infection. Journal of the American College of Surgeons. 2010 Apr 1;210(4):381-9.

18. Weber WP, Zwahlen M, Reck S, Misteli H, Rosenthal R, Buser AS, Kaufmann M, Oertli D, Widmer AF, Marti WR. The association of preoperative anemia and perioperative allogeneic blood transfusion with the risk of surgical site infection. Transfusion. 2009 Sep;49(9):1964-70.

19. Schneid-Kofman N, Sheiner E, Levy A, Holcberg G. Risk factors for wound infection following cesarean deliveries. International Journal of Gynecology & Obstetrics. 2005 Jul 1;90(1):10-5.

20. Dutta DC. Medical and surgical illness complicating pregnancy. In: Konar H, editor. Textbook of Obstetrics. 6th ed. Kolkata: New Central; 2004. p. 262-305.

21. Kirby JP, Mazuski JE. Prevention of surgical site infection. Surgical Clinics of North America. 2009 Apr 1;89(2):365-89.

22. Lijaemiro H, Berhe Lemlem S, Tesfaye Deressa J. Incidence of surgical site infection and factors associated among cesarean deliveries in selected government Hospitals in Addis Ababa, Ethiopia,

2019. Obstetrics and gynecology international. 2020 Feb 22;2020.

23. Dhar H, Al-Busaidi I, Rathi B, Nimre EA, Sachdeva V, Hamdi I. A study of post-caesarean section wound infections in a regional referral hospital, Oman. Sultan Qaboos University Medical Journal. 2014 May;14(2):e211.

24. Martin ET, Kaye KS, Knott C, Nguyen H, Santarossa M, Evans R, Bertran E, Jaber L. Diabetes and risk of surgical site infection: a systematic review and meta-analysis. infection control & hospital epidemiology. 2016 Jan;37(1):88-99.

25. Iyoke CA, Ugwu GO, Ezugwu FO, Lawani OL, Onah HE. Risks associated with subsequent pregnancy after one caesarean section: A prospective cohort study in a Nigerian obstetric population. Nigerian Journal of Clinical Practice. 2014 Jun 23;17(4):442-8.