Avicenna J Clin Microb Infec. 2017 November; 4(4):e11955. doi: 10.5812/ajcmi.11955.

Published online 2017 August 31. **Research Article**

Incidence of Surgical Site Infection and Compliance with Antibiotic Prophylaxis in Cesarean Section in a Community Hospital in Qatar

Humberto Guanche Garcell,[1,*] Ariadna Villanueva Arias,[2] Daritza C Rodriguez Olivares,[3] Pedro A Chirino Acosta,[3] Edel M Sanchez Redonet,[4] and Ramon N Alfonso Serrano[3]

[1]Infection Control Department, The Cuban Hospital, Hamad Medical Corporation, Qatar
[2]Infection Control Department, The Cuban Hospital, Hamad Medical Corporation, Qatar
[3]Surgical Department, The Cuban Hospital, Hamad Medical Corporation, Qatar
[4]The Cuban Hospital, Hamad Medical Corporation, Qatar

[*]*Corresponding author*: Humberto Guanche Garcell, Infection Control Department. The Cuban Hospital, Hamad Medical Corporation, P.O. Box: 27555, Dukhan, Qatar. Tel: +974-70218464, E-mail: guanche@infomed.sld.cu

Received 2017 December 04; **Revised** 2017 April 22; **Accepted** 2017 July 16.

Abstract

Background: The current study aimed at describing the incidence, etiology of surgical site infections (SSI), and compliance with antibiotic prophylaxis in cesarean section during a 3.5 years period in a community hospital.
Methods: Prospective data were collected to monitor the incidence of SSI and compliance with antibiotic prophylaxis in 450 patients undergoing the procedure from January 2013 to June 2016.
Results: The mean age of the patients was 31.8 years, 14.3% had diabetes mellitus, 4.73% had overweight, and 54.4% of the procedures were elective; also, 69.8% of the procedures had risk index (RI) 0, 26.3% RI 1, and 16 patients had RI 2 and 3. Nine patients with SSI were reported, 8 with superficial incisional and 1 organ-space infections. The pooled infection rate in 2013 was 4.44%, followed by 1.10% in 2014, 1.52% in 2015, and 2.56% in January to June 2016; in addition, 1.04% of the study subjects were RI 0 and 4.50% RI 1. Methicillin-resistant *Staphylococcus aureus* was identified in 2 patients, and Methicillin-sensitive *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia* in 1 patient, respectively. Compliance with antibiotic prophylaxis increased from 53.5% in 2013 to 94.9% in January to June 2016.
Conclusions: The current study findings showed the effect of a multidimensional program to prevent surgical site infection in cesarean section, and the need to strengthen it.

Keywords: Cesarean Section, Surgical Site Infections, Compliance, Antibiotic Prophylaxis, Qatar

1. Background

Surgical site infections (SSI) constitute an important adverse event related to cesarean delivery with reported incidence up to 23.5% using post-discharge surveillance methods (1, 2). This causes significant clinical impact in terms of quality of care, the requirement of antibiotic treatment, prolonged hospital stay, and maternal deaths (3).

Recent reports from 18 countries describe SSI incidence of 0.7% (4), 2.66% in Oman (5), 9.8% in England (6), and 23.5% in Brazil (2). According to the Center for Disease Control and Prevention/National Health Safety Network (CDC/NHSN) in the USA, the pooled mean incidence rate of surgical site infection after cesarean section (C-section) (data collected from 2006 to 2008) was 1.46% for risk index (RI) zero, 2.46% for RI 1, and 3.82% for RI 2 and 3 (7). The incidence of surgical site infection is related with a myriad of risk factors including patient and procedure factors. Cultural and climatic factors (8) are suggested as an explanation for the differences in the incidence rates between countries, the healthcare resources, and the compliance with evidence-based infection control practices.

In public healthcare facilities in Qatar, the implementation of infection control practices is guided by a corporate department, based on the best evidence, and conducted at facility level by infection control practitioners (ICP) and a multidisciplinary infection control committee. There are not published data about the incidence of surgical site infections in cesarean section in healthcare facilities in Qatar. This is the reason why the quality improvement program applies the surveillance methods recommended by NHSN and as a target, less than the 50th percentile for each risk index, using NHSN data (7).

The current study aimed at describing the incidence, etiology of surgical site infections, and compliance with antibiotic prophylaxis in C-section in a community hospital in Qatar during a 3.5-year period.

2. Methods

A descriptive study was conducted in a 75-bed facility (the Cuban hospital) in Western Qatar, affiliated to Hamad Medical Corporation, the principal healthcare provider in the country. The study included all C-sections performed from January 2013 to June 2016. The 10 -bed maternity department receives patients from any locations of the country.

2.1. Data Collection

Data were collected by an ICP from patient files that included the duration of the operative procedure, ASA (American Society of Anesthesiologists) classification, and the degree of contamination of the surgical wound (clean-contaminated or contaminated). In cases of surgical site infection, the biological samples were collected (pus, fluid) and analyzed in the microbiologic laboratory. Also, information was collected about antibiotics prophylactic, which should follow the corporate policy that defines the administration of a single dose of cefazolin or clindamycin, given 15 to 60 minutes prior to skin incision. In addition, the age, comorbidities, and type of surgical procedure (elective or emergency) were collected.

Surveillance methods included hospital and post-discharge methods. Regarding the hospitalized cases, detection was performed using the clinical and laboratory data. Post-discharge surveillance was conducted mainly by means of patients file review (electronic file available across all corporate facilities) and laboratory reports.

2.2. Definition

Cases of surgical site infection were defined using the standard NHSN definitions including superficial incisional, deep incisional, and organ space infections (9). For each patient, the National Nosocomial Infection Surveillance (NNIS, the USA) risk index system was computed on the basis of an ASA score of more than 2, a wound class of contaminated or dirty/infected, and duration of procedure more than the cut point defined for CS (56 minutes), with each criterion met adding 1 point to the index.

2.3. Analysis

Data analysis was performed with JMP 10.0 (http://www.jmp.com/). The incidence of SSI was calculated by dividing the number of infections by the number of operations performed and multiplying by 100. The infection rates (mean and percentile distribution) were calculated for NNIS risk index (RI) 0, 1, and 2-3 combined. The compliance with the timing for administration of antibiotic prophylaxis was calculated by dividing the number of procedures in which the antibiotic was provided according to policy recommendation and the total number of procedures. Comparison between the Texas children hospital (TCH) infection rates and NHSN and the International Nosocomial Infection Control Consortium (INICC) data were performed using the Student T-Test.

2.4. Ethical issues

The collected data constituted a regular component of the local infection control program as well all the prevention practices implemented, all of them were subjects to patient consent during patient care activities. The study received ethical approval for publication from the quality management department.

3. Results

From January 2013 to June 2016 a total of 450 C-sections were performed and the number of cesarean delivery increased steadily with 45, 91, 197, and 117 procedures in 2013, 2014, 2015, and January to June 2016, respectively. The mean age of the patients was 31.8 years ranging from 19 to 46; 14.3% had diabetes mellitus, 4.73% had overweight (body mass index (BMI) > 30 kg/m^2), and 54.4% of the procedures were elective, while the others were emergency C-sections. Also, 69.8% of procedure had RI 0, and 26.3% RI 1 with only 16 patients with RI 2 and 3.

It was reported that 9 patients had surgical site infections, 8 of them superficial incisional infections and 1 case was an organ-space SSI. The pooled SSI rate in 2013 was 4.44%, and 1.10% in 2014, 1.52% in 2015, and 2.56% from January to June 2016. The pooled SSI infection rates were 1.04% for RI 0 and 4.50% for RI 1, while for RI 2 and 3 the infection rate was not calculated since the number of procedures did not meet the minimum data (30 procedures) (Table 1). The The comparison of the pooled SSI rates was observed with the CDC/NHSN data and the INICC data did not show statistically significant differences. Nevertheless, the infection rate for patients under the RI 1 in the studied facility had higher pooled infection rate (4.50%) in comparison with CDC/NHSN (2.43%).

The methicillin-resistant *Staphylococcus aureus* (MRSA) was isolated from 2 patients, and methicillin-sensitive *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiellapneumonia* in 1 patient, respectively.

A sustained increase in compliance with the administration of the prophylactic antibiotic was observed during

Table 1. Surgical Site Infection Rates in Cesarean Section; TCH, INICC Hospital, and CDC-NHSN

Location	No. Procedures	No. SSIs	SSI Rate	Percentile				
				10	25	50	75	90
TCH								
RI 0	314	4	1.04	0,00	0.21	1.35	1.46	1,47
RI 1	120	4	4.52	0,00	0,00	2.78	10.77	12,50
RI 2,3	16	1	[a]					
Total	450	9	2.41	1.10	1.21	2.04	3.97	4.44
INICC[b]	13,668	395	2.9	0.12	1.5	2.0	5.3	8.2
CDC-NHSN								
RI 0	20.743	303	1,46	0,00	0,31	1,07	2,69	4,07
RI 1	8.995	219	2,43	0,00	0,00	1,82	4,32	6,45
RI 2,3	1.256	48	3,82					

[a] Infection rate no calculated due to low number of procedures in this risk index.
[b] Pooled risk categories

the study period with 53.5% in 2013, and subsequent annual data of 68.1%, 93.5%, and 94.9%, respectively (Figure 1). The emergency cases were related with noncompliance during the 2015 - 2016 period, while during the 2013 - 2014 period other factors explained the noncompliance, mainly the organizational factors.

4. Discussion

The current study was the first paper that described the incidence of the surgical site infection in cesarean sections in a healthcare facility in Qatar. Authors wish to highlight that during the first year of the study period, the SSI rate achieved the highest figure, probably related to gaps in the infection control program in a new facility (opened in 2012), and especially related to the compliance with antibiotic prophylaxis and the preoperative shower with chlorhexidine (CHG). The CHG preop shower was not implemented in 2013 and was recommended twice in electives cases (9 before and previous the procedure), and for emergency cases 1 shower before the procedure. Then, a substantial improvement was observed as a consequence of the applicationof the infection control program since it introduced into the armamentarium of any relative departments and units as well as staff (10). During January to June 2016, an increase in the infection rate was observed, which was mainly related to the high-risk patients and the ones who were noncompliance with antibiotic prophylaxis. Although the infection rate was lower during 2016 compared with that of 2013, this finding highlighted the needs to more strict control of patients' risk factors whenever possible.

The corporate infection control program was emphasized in surveillance and feedback of SSI and infection control practices (surgical site bundle, hand hygiene), and education of staff. In addition, the current study implemented an antibiotic prophylaxis policy, chlorhexidine gluconate preoperative bathing (using soap or towels embedded), MRSA screening and decolonization policy, patient and family education as well others the standard practices (10). Previous studies demonstrated the effectiveness of these measures in the prevention of SSI in C-section (10-15). Nevertheless, few infection control practices such as the preoperative shaving and bathing should be followed more closely. The preoperative shaving performed by the patients before coming to the hospital should be taught to patients and families, and the proper bathing should be ordered and monitored during the preoperative period. The compliance with timing of antibiotic prophylaxis requires a close monitoring prior to the surgical procedure.

The majority of the infections were confirmed after discharge, emphasizing the role of the post-discharge surveillance component to provide accurate information about the infection rate (2, 6, 8, 10, 16, 17).

The microbial flora related to SSI in C-section was diverse according to the previous studies (1, 5, 18). Hidron AI et al. (18), according to NHSN data 2006 - 2007, described that the most common pathogens causing obstetric/gynecologic SSIs were *Staphylococcus aureus* (28.3%), coagulase-negative staphylococci (12.4%), *Enterococcus* species (10.1%), and *Escherichia coli* (9.6%). However, the current study highlighted the high proportion of MRSA,

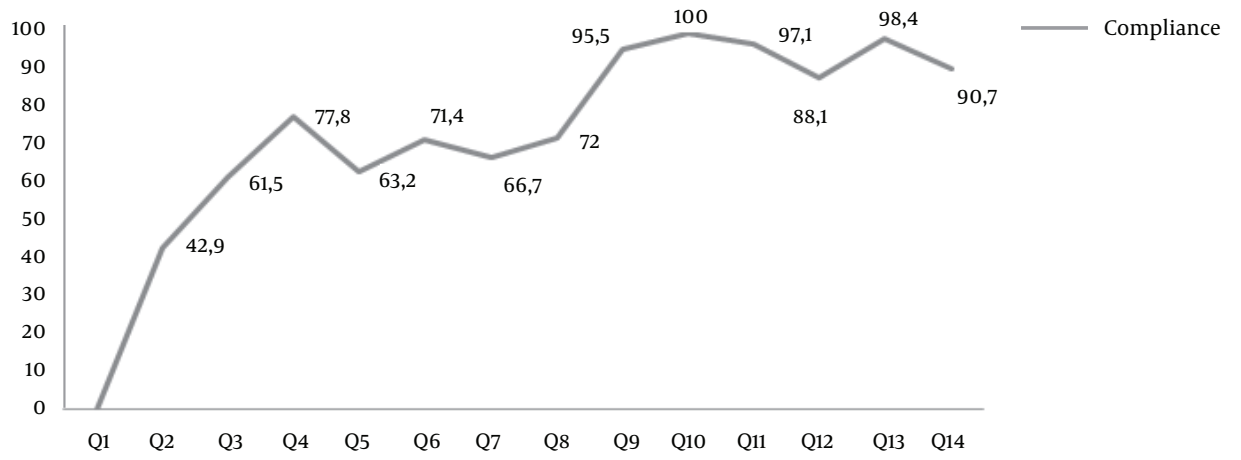

Figure 1. Compliance with Timing of Antibiotic Prophylaxis (Per 100 Procedures) in Cesarean Section from January 2013 to June 2016

frequently reported in healthcare associated infections, which requires additional studies and more emphasis on prevention measures addressed to this microbial agent.

The major strengths of the current study were that it represented the outcome of the infection control program and practices in a healthcare facility. Also, data collection was conducted using the corporate surveillance system recommendations in a standardized form and by trained infection control personnel. The important limitations of the current study were the limited possibility to demonstrate the impact of the introduction of each preventive measure in the incidence of surgical site infection and the small number of patients included in the study, which was according to the size and geographical location of the facility. Also, the limited number of procedures, related to the hospital capacity should be considered in the analysis of the infection rate; nevertheless, as per NHSN recommendation the surgical site infection rate could be calculated with more than 30 procedures.

4.1. Conclusion

The current study findings showed the effect of a multidimensional infection control program in the prevention of surgical site infection in cesarean section and the need to use this information as a benchmarking tool for the quality improvement program.

Acknowledgments

Authors would like to thank the assistance of Mr. Carlos L. Crespo Palacios for reviewing the paper.

Footnotes

Conflict of Interests: Authors declared no conflict of interest.

Funding/Support: There was no funding for this study.

References

1. Fitzwater JL, Tita AT. Prevention and management of cesarean wound infection. *Obstet Gynecol Clin North Am.* 2014;**41**(4):671–89. doi: 10.1016/j.ogc.2014.08.008. [PubMed: 25454997].
2. Cardoso Del Monte MC, Pinto Neto AM. Postdischarge surveillance following cesarean section: the incidence of surgical site infection and associated factors. *Am J Infect Control.* 2010;**38**(6):467–72. doi: 10.1016/j.ajic.2009.10.008. [PubMed: 20226571].
3. Jenks PJ, Laurent M, McQuarry S, Watkins R. Clinical and economic burden of surgical site infection (SSI) and predicted financial consequences of elimination of SSI from an English hospital. *J Hosp Infect.* 2014;**86**(1):24–33. doi: 10.1016/j.jhin.2013.09.012. [PubMed: 24268456].
4. Rosenthal VD, Richtmann R, Singh S, Apisarnthanarak A, Kubler A, Viet-Hung N, et al. Surgical site infections, International Nosocomial Infection Control Consortium (INICC) report, data summary of 30 countries, 2005-2010. *Infect Control Hosp Epidemiol.* 2013;**34**(6):597–604. doi: 10.1086/670626. [PubMed: 23651890].
5. 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 Univ Med J.* 2014;**14**(2):e211–7. [PubMed: 24790744].
6. Wilson J, Wloch C, Saei A, McDougall C, Harrington P, Charlett A, et al. Inter-hospital comparison of rates of surgical site infection following caesarean section delivery: evaluation of a multicentre surveillance study. *J Hosp Infect.* 2013;**84**(1):44–51. doi: 10.1016/j.jhin.2013.01.009. [PubMed: 23507051].
7. Edwards JR, Peterson KD, Mu Y, Banerjee S, Allen-Bridson K, Morrell G, et al. NHSN reports: 2006-2008 data. National healthcare safety network Atlanta: Association for Professionals in Infection Control and Epidemiology,Inc; 2009. [cited May 20, 2016]. Available from: http://www.cdc.gov/nhsn/dataStat.html.

8. Richet H. Seasonality in Gram-negative and healthcare-associated infections. *Clin Microbiol Infect.* 2012;**18**(10):934–40. doi: 10.1111/j.1469-0691.2012.03954.x. [PubMed: 22784293].
9. Tracking Infections in Acute Care Hospitals/Facilities. National Healthcare Safety Network (NHSN) [cited May 20, 2016]. Available from: http://www.cdc.gov/nhsn/acute-care-hospital/ssi/index.html.
10. Anderson DJ, Podgorny K, Berrios-Torres SI, Bratzler DW, Dellinger EP, Greene L, et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol.* 2014;**35**(6):605–27. doi: 10.1086/676022. [PubMed: 24799638].
11. Salim R, Braverman M, Berkovic I, Suliman A, Teitler N, Shalev E. Effect of interventions in reducing the rate of infection after cesarean delivery. *Am J Infect Control.* 2011;**39**(10):e73–8. doi: 10.1016/j.ajic.2011.05.001. [PubMed: 21835505].
12. Skjeldestad FE, Bjornholt JV, Gran JM, Erisken HM. The effect of antibiotic prophylaxis guidelines on surgical-site infections associated with cesarean delivery. *Int J Gynaecol Obstet.* 2015;**128**(2):126–30. doi: 10.1016/j.ijgo.2014.08.018. [PubMed: 25456970].
13. Hsu CD, Cohn I, Caban R. Reduction and sustainability of cesarean section surgical site infection: An evidence-based, innovative, and multidisciplinary quality improvement intervention bundle program. *Am J Infect Control.* 2016;**44**(11):1315–20. doi: 10.1016/j.ajic.2016.04.217. [PubMed: 27317407].
14. Witter FR, Lawson P, Ferrell J. Decreasing cesarean section surgical site infection: an ongoing comprehensive quality improvement program. *Am J Infect Control.* 2014;**42**(4):429–31. doi: 10.1016/j.ajic.2013.12.004. [PubMed: 24679571].
15. Tanner J, Padley W, Kiernan M, Leaper D, Norrie P, Baggott R. A benchmark too far: findings from a national survey of surgical site infection surveillance. *J Hosp Infect.* 2013;**83**(2):87–91. doi: 10.1016/j.jhin.2012.11.010. [PubMed: 23332352].
16. Bianco A, Roccia S, Nobile CG, Pileggi C, Pavia M. Postdischarge surveillance following delivery: the incidence of infections and associated factors. *Am J Infect Control.* 2013;**41**(6):549–53. doi: 10.1016/j.ajic.2012.06.011. [PubMed: 23219668].
17. Hidron AI, Edwards JR, Patel J, Horan TC, Sievert DM, Pollock DA, et al. NHSN annual update: antimicrobial-resistant pathogens associated with healthcare-associated infections: annual summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2006-2007. *Infect Control Hosp Epidemiol.* 2008;**29**(11):996–1011. doi: 10.1086/591861. [PubMed: 18947320].
18. Sievert DM, Ricks P, Edwards JR, Schneider A, Patel J, Srinivasan A, et al. Antimicrobial-resistant pathogens associated with healthcare-associated infections: summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2009-2010. *Infect Control Hosp Epidemiol.* 2013;**34**(1):1–14. doi: 10.1086/668770. [PubMed: 23221186].