

January 2013

# Rational use of antibiotics--a quality improvement initiative in hospital setting

Sidrah Nausheen
*Aga Khan University*

Rabia Hammad
*Aga Khan University*

Ambreen Khan
*Aga Khan University*

ORIGINAL ARTICLE

# Rational use of antibiotics — a quality improvement initiative in hospital setting

Sidrah Nausheen, Rabia Hammad, Ambreen Khan

## Abstract

**Objectives:** To minimise irrational use of antibiotics by implementing guidelines for antibiotic usage in obstetrics and Gynaeocology.

**Methods:** The observational study was conducted from January to December 2010 at the maternity unit of Aga Khan Hospital for Women and children, Kharadar, a secondary care facility in Karachi, Pakistan. Data was collected from medical records related to the study period. Prophylactic antibiotics were given according to the American College of Obstetricians and Gynaecologists recommendation 2009. Surveillance was done by surgical site infection rates and infectious morbidity. Data was analysed on SPSS 13.

**Results:** Therapeutic antibiotic use was rationalized, reducing the use of therapeutic antibiotics from 97% (n= 160/165) in January 2010 to 8% (n=10/125) in December 2010. Surgical site infection rates were less than 5%. Cost of antibiotics per patient decreased by 90%. Decrease in the length of stay and workload on nursing staff was also observed.

**Conclusion:** Implementing guidelines for antibiotic use in obstetrics and gynaecology and translating it into our protocols was effective in decreasing the irrational antibiotic consumption and increasing the rational use of antibiotics in the hospital.

**Keywords:** Antibiotics, Rational use, Obstetrics and gynaecology. (JPMA 63: 60; 2013)

## Introduction

Antibiotics are powerful and effective drugs in the fight against infectious diseases caused by bacteria, and have saved millions of lives since their first appearance about 50 years ago. Rational use of antibiotics is extremely important as injudicious use can adversely affect the patient, cause emergence of antibiotic resistance and increase the cost.[1,2] As per the World Health Organisation, rational use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, and at the lowest cost to them and their community ( WHO,1987). The use of antibiotic prophylaxis has been shown to prevent post-surgical wound infection. When employed rationally, significant reduction in the mortality and morbidity and saving in resources can be achieved.[3,4]

The purpose of antibiotic prophylaxis is to prevent post-operative infections, which are the primary cause of morbidity and mortality in patients undergoing surgery today. Aseptic techniques alone could decrease, but do not completely eliminate bacterial contamination of the surgical field. Therefore, the need for antibiotics to supplement aseptic technique becomes more widely accepted.[5] In Pakistan, there are no proper prophylactic guidelines. In most hospitals and clinics, including our hospital, conventional antibiotic therapy is given usually for 7-10 days to postnatal patients with episiotomy as well as post-surgical patients. It increases the cost for the patient, increases workload on hospital staff and results in emergence of antibiotic resistance. Despite the knowledge about effectiveness of prophylactic antibiotics, administrative regimens are often inappropriate and, secondly, duration of prophylaxis is often longer than recommended. This over and prolonged use has contributed to overwhelming rate of antibiotic resistance in Pakistan and thus increase in surgical wound infection rate.

Literature review suggests that prophylactic antibiotics when given in appropriate dose and at proper time, 30 minutes before surgery, provides effective tissue concentration prior to intra-operative bacterial contamination, and, thus reduces infectious morbidity.[6] Numerous antibiotics have been used, but there is no consensus as to the most appropriate agent. The duration of antibiotic administration has not been defined precisely, but it appears that a single dose of an antibiotic with a sufficiently long half-life can be as effective as prolonged courses of prophylaxis. A single dose given pre-operatively has less cost, less potential for toxicity, and less chance of promoting resistant bacteria.[7]

The American College of Obstetricians and

Department of Obstetrics and Gynaeocology, Aga Khan University Hospital, Karachi.

**Correspondence:** Sidrah Nausheen. Email: sidrahnausheen@aku.edu

Gynaecologists (ACOG) has issued a practice bulletin on antibiotic prophylaxis for gynaecologic and obstetric procedures. The choice of an appropriate antimicrobial agent for prophylaxis should take into account that the agent selected must be of low toxicity, have an established safety record, not be used routinely to treat serious infections, have a spectrum of activity including the micro-organisms most likely to cause infection, achieve therapeutic concentration in relevant tissues during the procedure, be administered for a short time, and be administered in a manner that will ensure its presence in surgical sites at the time of the incision.[8]

"The cephalosporins have emerged as the drugs of choice for most operative procedures because of their broad antimicrobial spectrum and the low incidence of allergic reactions and side effects," says the guideline which also recommends "Cefazolin (1g) as the most commonly used agent because of its reasonably long half-life (1.8 hours) and low cost."

In our hospital setting, therapeutic antibiotics were given injudiciously in multiple dosage at the consultant's discretion and personal choice, as there were no proper guidelines being followed. To address this issue, we took a quality care initiative by implementing ACOG guidelines (2009) for prophylactic antibiotic usage in obstetrics and gynaeocology, and studied the decrease in irrational use of antibiotics and the impact on surgical site wound infection in obstetrics and gynaeocology patients.

## Patients and Methods

The observational study was conducted at Aga Khan Hospital for women and children, Kharadar, from January 2010 to December 2010.

During the planning phase i.e. January 2010, we worked with the staff to increase their awareness and practices about infection control policies, explained the rationale, methodology of implementing guidelines to all consultants and staff.

The guidelines were implemented from Feb 2010. During the study period, teaching and monitoring of infection control practices were done monthly. To ensure compliance with the guidelines and to monitor decrease in the irrational use of therapeutic antibiotics, a monthly report was presented to the infection control committee, and the action plan was reviewed accordingly, if needed.

All patients who received single dose or three doses of cefazolin 1gm finishing within 24 hours of surgery were recorded as prophylactic antibiotics, and those who received antibiotics more than 24 hours between 3 and 5 days were recorded as therapeutic antibiotics, rationality of which was then recorded.

All patients with gynaecologic problems for elective vaginal or abdominal hysteretectomy, laparotomy, dilatation and evacuation, minilap for tubal ligation, curettage of uterus and all pregnant females undergoing elective or emergency caesarean section, spontaneous or instrumental delivery with episiotomy were given single-dose prophylaxis with cefazolin 1gm intravenous at the time of induction of anaesthesia in gynae patients and after cord-clamping in obstetric patients. All patients who delivered spontaneously without episiotomy or tear and had no history of fever, ruptured membranes or diabetes were not given any antibiotic.

Women who had known or suspected hypersensitivity or intolerance to cephalosporin were given clindamycin as per the guideline. Those who had any co-existing disease like diabetes mellitus, fever, rupture membranes more than 18 hours, premature pre-labour rupture of membranes were given therapeutic antibiotics for five days. In obese patients, more than 80 kg, dose was increased to cefazolin 2gm intravenous. If surgery lasted more than 3 hours or blood loss more than 1500 ml, a second dose of cefazolin 1gm was repeated.

A protocol was implemented emphasising on giving bath prior to surgery, avoid removal of hair with razors, effective hand-washing and scrubbing techniques, decreasing operating room traffic during surgery, maintaining effective sterilisation of the operating room, labour room and instruments as per the standard criteria, giving sponge and bath on 1st and 2nd post-operative day; removing dressing on 2nd post-operative day; discharge on the 3rd post-operative day.

Data was collected from medical records on a prescribed proforma. Data on demographics, type of surgery, timing and dose of antibiotics, duration of surgery, complications, post-operative infectious morbidity, surgical site wound infection and hospital stay were extracted from the record and analysed.

An approval from the ethical review committee was sought prior to the study.

Within 24 hour prior to surgery, a baseline assessment was performed that included the measurement of vital signs (pulse rate, respiration rate, blood pressure and body temperature), general physical, systemic and gynaecological examinations. Blood and urine samples were also sent for haematology, blood chemistry and urine analysis.

During the post-operative period, 4-hourly temperature charting was maintained. Abdominal and perineal examination was performed daily. The wound was inspected for superficial and deep infection, pus discharge, abscess formation and wound dehiscence. If body temperature was greater than 38.5°C, complete blood count, urine detailed report, blood and urine culture were sent. If the white blood cell count was greater than 12,000, evidence of infection or fever, therapeutic antibiotics were started.

On discharge, patients were instructed to contact if they experience signs and symptoms of infection. All patients were monitored for 30 days post-operatively. The outcome measures were febrile morbidity and infectious morbidity including wound infection and scar dehiscence. The results were analysed on SPSS 13.

## Results

A Total of 1710 patients were studied during the period of one year. Of the total, 1564 (91.54%) were obstetric patients and 146 (8.5%) gynae surgical patients (Table-1). Patients with caesarean section were 511 (32.67%) and 1053 (67.32%) were vaginal deliveries. The mean age of obstetric patients was 25±2.5 years and gynae patients 33±3.5 years.

In January the overall rate of therapeutic antibiotic in our patients was (160/165) 97% (Table-2). During the study period continuous monitoring and emphasis on reducing irrational use of therapeutic antibiotics and giving therapeutic antibiotics only when needed brought the usage down to (10/125) 8% by December 2010 without increasing infectious morbidity above the benchmark of 5%.

A single dose of 1gm cefazolin was given pre-operatively as per guidelines, while the second dose was given in 80 (15.65%) patients and the third dose in 40 (7.8%) patients as per the consultant's discretion.

Table-1: Surgical procedures.

| Surgical Type | Number | Percentage |
|---|---|---|
| Caesarean section | 511 | 78% |
| Total abdominal hysterectomy | 15 | 2.2% |
| Vaginal hysterectomy | 5 | 0.7% |
| Laparotomy for (ectopic, cystectomy) | 15 | 0.7% |
| Dilatation and evacuation | 82 | 12.5% |
| Dilatation and curettage | 25 | 4% |
| Myomectomy | 4 | 0.6% |
| | Age (Years) Mean±S.D | Duration of Surgery (Minutes) Mean (MIN) |
| Gynaecological patient | 33±3.5 | 80±60 (major surgery) |
| Obstetric patients | 25±2.5 | 40±26 |

Table-2: Monthly chart showing reduction in antibiotic usage.

| Month | Patients receiving therapeutic antibiotics | Total patients | Percentage | *Surgical site infection rates (n)% |
|---|---|---|---|---|
| January | 160 | 165 | 97% | (5)3% |
| February | 62 | 115 | 54% | (4) 3.4% |
| March | 45 | 107 | 42% | (3) 2.6% |
| April | 43 | 108 | 40% | (4) 3.7% |
| May | 50 | 130 | 38% | (4) 3.0% |
| June | 36 | 156 | 23% | (4) 2.5% |
| July | 63 | 157 | 40% | (6) 3.8% |
| August | 35 | 181 | 20% | (4) 2.2% |
| Sept | 15 | 150 | 10% | (3) 2.0% |
| October | 20 | 156 | 13% | (4) 2.5% |
| November | 12 | 160 | 8% | (5) 3.1% |
| December | 10 | 125 | 8% | (3) 2.4% |
| Total | | 1710 | | |

*Surgical site infection rate= Number of patients with infected wounds or episiotomy / Number of patients underwent surgery or delivered.

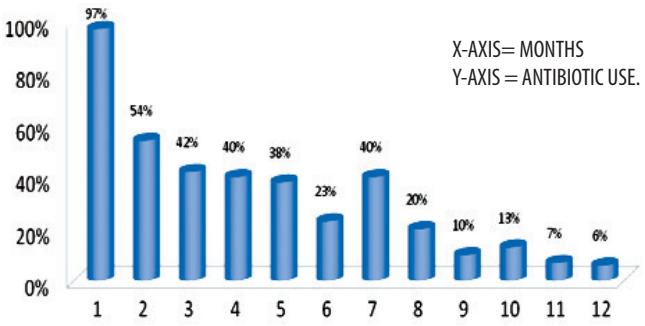


**Figure:** Decrease in therapeutic antibiotic usage over a year.

The mean duration of surgery in obstetric patients was 40±25 minutes and major gynae surgery was 80±68 min. During obstetric surgery, 3 (0.58%) patients had blood loss more than 1000ml and received therapeutic antibiotics as balloon tamponade was done. No intra-operative surgical complication was seen except one case of incisional haematoma which was then drained. Two (0.18%) cases of vaginal haematoma after instrumental delivery, received therapeutic antibiotics. The mean duration of hospital stay of surgical patients was 3.0±1 days.

Post-operative surgical site infection rates were also noted (Table-2). Patients were being called at home on phone by the infection control nurse till 30 days post-operatively to check for any signs of infection like discharge from the wound, redness, or fever. Patients were seen in the clinic after one week and then 3 weeks for followup. Out of surgical site infections, 25 patients developed superficial wound infection with serosanginuous discharge or redness, only 3 cases of deep

infection with complete gaping of wound, no case of pelvic abscess or wound dehiscence was recorded. During the post-operative period, 20 patients reported fever out of which 7 had evidence of infection on blood counts, and were started on therapeutic antibiotics. The remaining cases settled within 24 hours. No case of urinary tract infection or chest infection was reported.

The total cost of antibiotic charged to the patient was also reduced. The mean total cost of 5-day therapy was approx. Rs 2000±2.5 whereas the cost of single dose prophylactic cefazolin 1gm was only Rs150. Thus, the cost was reduced by 90%.

Additional benefit was reduced workload on the nursing staff. Giving intravenous antibiotics for 3 or 5 days was taking a lot of time and manpower. By reducing it to single dose, time and manpower was rationalised.

Hospital stay also decreased from 5 days to a mean of 3±1.5 days which again decreased the cost of total cost to the patient by nearly 25%.

## Discussion

This study provides evidence that by implementing standard guidelines/protocols, quality care and patient safety goals can be achieved. By implementing guidelines for antibiotic prophylaxis, we were able to rationalise the use of therapeutic antibiotics and reduced its use from 97% to 8%. Through this study we were able to achieve our objective of decreasing the irrational antibiotic usage. Additional benefits included cost-effectiveness, decreased length of stay and decreased workload on the nursing staff.

Surgical site infections (SSIs) are the second most common type of adverse event.[9] Evidence has shown that SSIs increase mortality, re-admission rate, length of stay, associated costs and economic burden.[10] The overall infection rate is around 5%,[10] but varies from surgeon to surgeon, hospital to hospital, one procedure to another and even from one patient to another patient. Our results of SSI rates are well within the benchmark of 5% as reported in literature.[10] We followed our patients for 30 days post-operatively which is proposed in literature and this reaffirms the conclusion of other studies[11] that post-discharge surveillance is important in achieving more accurate SSI rates. The factors associated with SSI were diabetes, obesity, nutritional status of patient and surgical technique. It may be difficult to compare our results of SSI to those reported in literature as our study was confined to obstetric and gynaecology department and the numbers were low.

Prevention of SSI remains the basic concern of the surgeon and appropriate prophylactic antibiotics can reduce these potential infections as proposed by many researchers.[12-15] Selection of appropriate antibiotic for the procedure, its dose, timings and duration are important contributing factors. Literature shows that about 30-50% of antibiotics use in hospitals is for surgical antibiotic prophylaxis, and between 30%-90% of this prophylaxis is inappropriate.[16] The antibiotic is either given at the wrong time or continued for a long period, thus making it ineffective.[17] Apart from the prophylaxis, skill of the surgeon, good haemostasis, minimal tissue trauma, avoidance of dead space and fluid collection, sterilisation of theatre equipment and theatre premises are important factors in minimising infection.[18] In our study we covered all aspects of sterilisation, gave prophylaxis at appropriate time and effective dose to prevent wound infection and infectious morbidity.

The SSI rate in our study was less than 5% and the estimated length of stay was 3.5 days. There was also no post-operative respiratory tract or urinary tract infection. Broodt PJ[19] reported reduction in the number of urinary tract infection in his study with single-dose regimen. In our study, there was obvious reduction in wound infection and mean hospital stay. Itskovitz J[20] also concluded in his study that short course of prophylaxis effectively decreases the febrile morbidity, serious post-operative infection and hospital stay.

Literature review shows that single dose regimen also results in an obvious reduction in the costs of antibiotic used, without an increase in morbidity.[21,22] Our study also proves the same as there was reasonable reduction in total bills of the patient due to decreased stay in hospital. Similarly a study conducted by Her-Young[23] has shown that single dose of antibiotic prophylaxis can reduce the antibiotic cost by 75-80%. Additional savings were also found and were related to decreased resistant organism outbreaks, decreased post-operative wound infections, decreased length of hospital stay, re-admissions, repeated surgeries, and re-treatments.

In Pakistan, surgeons surmised that prolonged antibiotic use would lower the incidence of post-operative infections, including wound space, and organ infections. However, a 14-year study group pointed out that prolonged use of antibiotics did not reduce the rate of superficial incision or organ/space SSIs. Prolonged anti-bacterial coverage changed the bacterial flora from susceptible species to resistant species; thus it contributed to increase in resistant species outbreaks, for example, of methicillin-resistant Staphylococcus aureus.[24]

There is clear evidence supporting the standardised administration of pre-operative prophylactic antibiotics. However, it remains unclear how to do that in a broad fashion. Different impediments exist in every hospital and overcoming these obstacles is a challenge that requires a multidisciplinary effort. Multiple antibiotics are available and information about antibiotic use pattern is necessary to formulate a constructive approach to the problem of irrational drug use.

A combination of non-regulatory and regulatory interventions are required at all levels of healthcare setup in Pakistan to control and avoid the emergence of drug-resistant bacteria due to irrational use of antibiotics in hospitals as well as community. The former includes in-service training of health personnel, awareness sessions. Regulatory intervention includes implementation of standard protocols/guidelines in hospital setting, regulation of infection control practices, maintaining sterilisation, conducting audits. More evaluation research is needed on different types of intervention strategies in various healthcare settings for conclusive evidence to be collected for specific intervention strategy.

## Conclusion

We were able to decrease irrational use of antibiotics by implementing the guidelines and translating it to our protocols. Additional benefits of this quality improvement project was cost-effectiveness and decreased workload on the nursing staff.

## References


1. Lim VKE, cheongYm, Suleiman AB. Pattern of antibiotic usage in hospital in Malaysia. Singapore Med J 1993; 34: 525-8.
2. Mc Donald LC, Yu HT, Yin HC, Hsiung AC, Ho M. Use and abuse of surgical antibiotic prophylaxis in hospital in Taiwan. J Formos Med Assoc 2001; 100: 5-13.
3. Kunin CM, Lipton HL, Tupasi T, Sacks T, Schecker WE, social ,behavioural and practical factors affecting antibiotic use worldwide. Report of task force 4. Rev Infect Dis 1987; 9 (suppl 1): S270- S85.
4. Ledger WJ, Prophylactic antibiotics in obstetrics and Gynaeocology. A current asset, a future liability? Expert Rev Anti Infect Ther 2006; 4: 957-64.
5. Gudiol F. Surgical antibiotic prophylaxis, tradition and change. Int J Clin Pract 1998; 95 (Suppl 1): 398-438.
6. ACOG - antibiotic prophylaxis for gyneocologicprocedures . Obstetrics Gynaecol 2006; 108: 225-34.
7. Pena AC, Dumo CC Jr. Antimicrobial use at the UERMMC. Phil J Microbiol Infect Dis 1995; 24: 59-60.
8. Laurie Barclay, MD Guidelines Issued on Antibiotic Prophylaxis for Gynecologicand obstetric. Procedures Obstet Gynecol 2009; 113: 1180-9.
9. Brennan TA, Leape LL, Laird NM, Hebert L, Localio AR, Lawthers AG, et al. Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. N Eng J Med 1991; 6: 370-6.
10. Hkirkland KBH, Briggs JP, HTrivette SLH, HWilkinson WEH, HSexton DJH. The impact of surgical-site infections in the 1990s: attributable-mortalit, excess length of hospitalization, and extra costs. Infect Control Hosp Epidemiol 1999; 725-30.
11. Eriksen HM, Chugulu S, Kondo S, Lingaas E. Surgical Site infections at Kilimanjaro Christian Medical Centre. J Hosp Infect 2003; 55: 14-20.
12. Eason EL, Well GA, Garber GE, Hopkins ML. Vaginal Antiseptic for abdominal Hysterectomy Study group. Prophylactic antibiotics for abdominal hysterectomy: Indication for low risk Canadian women. J Obstet Gynaecol Can 2004; 26: 1067-72.
13. Di Luigi AJ, Peipert JF, Weitzen S, Jamshidi RM. Pro-phylactic antibiotic administration prior to hysterec-tomy: A quality improvement initiative. J Reprod Med 2004; 49: 949-54.
14. Kocak I, Ustum C, Gurkan N. Prophylactic antibiotics in elective abdominal hysterectomy. Int J Gynaecol Obstet 2005; 90: 157-8.
15. Peipert JF, Weitzen S, Cruickshank C, Story E, Ethri-dge D, Lapane K. Risk factors for febrile morbidity after hysterectomy. Obstet Gynaecol 2004; 103: 86-91.
16. Munckhof W. Antibiotics for surgical prophylaxis. Aust Prescr 2005; 28: 38-40.
17. Dettenkoffer M, Forster DH, Ebner W, Gastmeier P, Ruden H, Daschner FD. The practices of perioperative prophylaxis in eight German hospitals. Infection 2002; 30: 164-7.
18. Sheikh I A, Iqbal P. Antibiotic prophylaxis in surgery. Pak J Surg 1999; 15: 55-7.
19. Broodt PJ, Snijders WP. Janknegt K. Single dose pro-phylaxis in Hysterectomies. J Pharm World Sci 1990; 12: 280-3.
20. Itskovitz J, Fisher M, Urbach J, Brandes JM. The effect of short term course of antibiotic prophylaxis on patients undergoing total abdominal hysterectomy. Euz J Obstet Gynecol Reprod Bio 1980; 11: 101-7.
21. Ahmed F, Wasti S. Infectious complication following abdominal hysterectomy in Karachi Pakistan. Int J Gynaecol Obstet 2001; 73: 27- 34.
22. Matteso KA, Peiper JF, Hirway P, Cotter K, Dil Luigi AJ, Jamshidi RM. Factors associated with increased charges for hysterectomy. Obstet Gynecol 2006; 107: 1057-63.
23. Her-Young SU, Dah-C D, Da-Chung C, Mei- Fen L, Jah Y L, Feng-Yee C. Prospective randomized com-parison of single dose vs 1- day cefazolin for prophy-laxis in gynecologic surgery. Acta Obstet Gynaecol Scand 2005; 84: 384-8.
24. Chen ML, Chang SC, Pan HJ, Hsueh PR, Yang LS, Ho SW, et al. longitudinal analysis of methicillin - resistant staphylococcus aureus isolates at a teaching hospital in Taiwan. J Formos Med Assoc 1999; 98: 426-32.