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Antibiotic Prophylaxis for Surgical Site Infection in Pediatric Surgery

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Abstract

Surgical site infection (SSI) in a serious complication requiring prolonged hospitalization, intravenous antibiotics, wound care and dressings resulting in increased cost and resistant bacteria. Despite the new advances in asepsis and surgery, postoperative (SSI), still considered a serious morbidity. Several reports suggest that (SSI) may be prevented by the administration of appropriate antimicrobial regimes. Quality improvement techniques in surgery are in continued practice since long time with the aim to reduce (SSI) rate. Many centers are implementing standardized protocols in using antibiotic prophylaxis for (SSI) to achieve the best outcome. In this study, we present the effectiveness of our hospital protocol for the use of antibiotic prophylaxis for (SSI). After approval of the study from ethical and research committee, the data of all pediatric patients who underwent uncontaminated procedures in general pediatric surgery & urology at Queen Rania Hospital for Children were reviewed prior and after the implementation of the new hospital protocol using the current literature. All patients who had infection, obvious contamination or on antibiotic treatment were excluded from the study. Other exclusion criteria were re operation, diabetic patient, malignancy, steroid treatment, clean inguinoscrotal surgery, circumcision and patients with allergy, blood or metabolic disorders. According to our hospital protocol, antibiotic prophylaxis for (SSI) will continue for 3 doses over 24 hours. The choice of single or combined antibiotic depends on the type of surgery. Cefazolin was the first choice for most procedures. For gastrointestinal surgery Cefoxitin (40mg/kg) and Metronidazole (15mg/kg) were used in combination. Cefazolin (30mg/kg) alone or with Gentamycin (2,5mg/kg) were used for urogenital surgery. Antibiotic should be administered intravenously one hour prior surgery. Procedures and (SSI) were evaluated prior and after protocol implementation. Thirteen pediatric surgeons in the hospital performed 11.000 procedures between March 2010 – March 2014. The minimum follow-up period for (SSI) was 4 weeks, 2000 procedures (group I) met the criteria prior the implementation of the hospital protocol and 2000 procedures (group II) met the criteria after the implementation of the protocol. The (SSI) rate decreased from 8.4 % (group I) to 4.6% (group II). Over all protocol implementation commitment was 86% and improved during the observation interval. The implementation of a standardized protocol for antibiotic prophylaxis in pediatric surgery significantly reduces (SSI). Generally, the protocol compliance was very good and easy to practice. The implementation of the hospital protocol has been considered as baseline in our major medical center and other hospitals for proper assessment of new treatments plans. The identification of factors associated with (SSI) will help in the revision and improvement of protocols in the future resulting in more control and reduction of (SSI) with significant cost effective results, less hospitalization and less bacteria resistance.

Keywords: Surgical site infection, antibiotic prophylaxis, quality improvement, standardized protocol.

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Introduction

Postoperative surgical site infection (SSI) adds a significant burden to the health system and suffering for patients and medical staff. The (SSI) accounting for 24% of all hospital- acquired infections and the second most common [1]. (SSI) is a major source of morbidity, prolonged hospitalization, and increased health care expenses. Unfortunately, an increasing number of resistant bacteria, such as methicillin-resistant Staphylococcus aureus (MRSA) and Candida spp., are commonly encountered in surgical wound infections. The aim of prophylactic antibiotics is to minimize the (SSI) rate. Limited number of publications for the risk and incidence of (SSI) in children were found that specifically address the problem of wound infections in children [2,3] compared to the large series for the adult population . These studies have reported the overall (SSI) rates from 2.5%6 to 20%.[4] , few of these reports excluded day case surgery and operations performed in the intensive care and neonatal units. The optimum regimens for selection of the appropriate antibiotic remain unestablished. Comparative studies examined if single drug, or a combination, is superior to others. The value of second and third generation cephalosporins that widely implemented as prophylactic antibiotics for (SSI) in the majority of surgical procedures still not confirmed [5,6] . Recent report showed that still there is small number of studies concerning the value of prophylactic antibiotics for prevention (SSI) in children and concluded that proper administration of preoperative antibiotics in pediatric patients is a significant factor in prevention of SSI [7] ,another updated report [8] which we support in our study suggests that there is no statistically significant difference in the rate of early post-operative wound infection between the patients who received single dose of pre-operative antibiotics and the patients who received no antibiotics after inguinoscrotal surgery.

The risk of (SSI) in paediatric heriotomies does not increase even if the child's weight is less than his/her expected weight for age. Until 4 years, there were no antibiotic prophylaxis protocol or guidelines in our hospital for (SSI) in children, so many children received no prophylaxis or inappropriate medication in inappropriate timing with the result of increased (SSI) rates, increased bacterial resistance and increased cost. To our knowledge, implementation of standardized preoperative protocols across many centers in our country and abroad has not been conducted. Our goal was to utilize these quality improvement steps for (SSI) control in pediatric surgery to reduce the 4 weeks (SSI) rate. In our study we aimed to evaluate our results prior and after our new hospital protocol of antibiotic prophylaxis for (SSI) in children.

Patients and Methods

With Institutional Review Board approval, the data of all pediatric patients who underwent uncontaminated surgical procedures in general pediatric surgery & urology at Queen Rania Hospital for Children over 4 years period were reviewed prior and after the implementation of the new hospital protocol using the current literature. All patients who had infection, obvious contamination or on antibiotic treatment were excluded from the study. Other exclusion criteria were re operation, diabetic patient, malignancy, steroid treatment, clean inguinoscrotal surgery, circumcision and patients with allergy, blood or metabolic disorders. Procedures lasting more than 4 hours were excluded from the study as well. According to our hospital protocol, antibiotic prophylaxis for (SSI) will continue for 3 doses over 24 hours. The choice of single or combined antibiotic depends on the type of surgery. For gastrointestinal surgery Cefoxitin (40mg/kg) and Metronidazole (15mg/kg) were used in combination. Cefazolin (30mg/kg) alone or with Gentamycin (2,5mg/kg) for urogenital surgery [Table -1]. Children with body weight above 40 kg will receive the adult dose. Intravenous administration of the antibiotics one hour prior surgery as written order. Redosing for Cefazolin after 4 hours intra-operatively while after 2 hours for Cefoxitin while no need for redosing of Gentamycin and Metronidazole. Procedures and (SSI) were evaluated prior and after protocol implementation. The intra-operative findings will guide the surgeon to continue the prophylactic antibiotic protocol or to shift for empiric treatment accordingly. Patients with drains and catheters will continue long term prophylaxis in other guideline but not for (SSI). Patients who met the criteria were followed 4 weeks post operatively. We consider (SSI) if we observe pus or cloudy fluid draining from the incision, yellow crust has formed on the wound, increasing redness around the wound, the wound has become extremely tender, pain or swelling is increasing 48 hours post operatively, the lymph node draining that area of skin may become large and tender, the wound hasn't healed within 14 days after the surgery. Unpaired *t*-test was used for data analysis. Chi-square test was used for interpretation of group’s data. A *P*-value of less than 0.05 was accepted as statistically significant.

Table 1: Doses and redosing of antibiotics used for (SSI) prophylaxis in children for surgical procedures up to 4 hours.

Antibiotic	**mg/kg**	**Redosing after infusion**
Cefazolin	30mg/kg	4 hours
Cefoxitin	40mg/kg	2 hours
Gentamycin	2.5mg/kg	NO
Metronidazole	15mg/kg	NO

Results

Thirteen pediatric surgeons in the hospital performed 11.000 procedures between March 2010 – March 2014. The minimum follow-up period for (SSI) was 4 weeks, 2000 procedures (group I) met the criteria prior the implementation of the hospital protocol and 2000 procedures (group II) met the criteria after the implementation of the protocol [Table II]. Both groups were found to be comparable regarding age, body weight and gender. The (SSI) encountered in 168 patients in (group I) 8.4% while in (group II) , (SSI) encountered in 92 patients 4.6% , P value < 0.05 . Over all protocol implementation commitment was 86% and improved during the observation interval. Accumulative prolonged hospitalization for (group I) was 850 days, while for (group II) was 378 days. The average cost for the patient per day of admission form both groups was 300 USD including hospital stay, medications, dressings, specific intravenous antibiotics and other expenses.

Discussion and Conclusion

Large number of studies has been focused on the value of prophylactic antibiotics in the reduction of (SSI). Multiple antibiotics have been used, either singly or in combination in numerous adult series and to less extent in children. The data from these studies favored a single dose of antibiotic preoperatively which proved effective as 5 days post-operative treatment course for smooth surgery without complications and should be appropriate for the anticipated flora [9, 10, 11]. It is essential to distinguish between prophylaxis and empiric treatment. Prophylaxis is indicated when high infection rates are expected, like procedures with implantation of prosthetic devices, and patients in whom the infection is serious. The antibiotic should cover the spectrum of contaminating flora. It should be given one hour prior surgery to achieve high tissue concentration at the incision site and the therapeutic concentration level should be maintained throughout operation. The intraoperative findings will guide the surgeon for empiric antibiotic therapy which will continue post operatively that addressed in a separate guideline. The improper use of broad-spectrum antibiotic beyond the recommended period for prophylaxis will affect adversely the patient by increasing risk of resistance of bacteria Post operative therapeutic antibiotic cover should be tailored to dirty and contaminated surgical field. [9,10,11,12,13]. Antibiotic prophylaxis for (SSI) had been tried in neurosurgery, orthopedic surgery , cardiac surgery , plastic surgery , ENT surgery and gynecology as protocols with reasonable outcome[14,15,16,17,1819] . Prophylactic antibiotics for (SSI) must be given one hour before skin cutting that we advise as well redosing should be administered if the surgical procedure time exceeds 4 hours [9,10,12]. Patients who are under antibiotic treatment for infection before any surgical intervention need no additional antibiotics for prophylaxis when they have similar spectrum of activity but still adequate antibiotic concentrations at the wound site before cutting is still warranted, this can be achieved by redosing of used antibiotic as recommended by the patient medication chart. Since there were no widely implemented guidelines and hospital protocols for the use of antibiotics prophylaxis for (SSI) in children, we elected to initiate such protocol based on the review of literature in pediatric surgery and other surgical specialties. Our hospital protocol proved to be effective and comparable to other protocol and guidelines by reducing the (SSI) rate from 8.6% prior protocol implementation to 4.6% after protocol implementation without jeopardizing the patient safety. It proved to be cost effective, safe, and easy to practice and we recommend its implementation in all pediatric surgical units.

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