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Original Research Article

Prophylactic Antibiotic and Surgical Site Infection in Neonates: A Retrospective Study

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Conflict of interest: Nil

Abstract:

Background and Objectives: Surgical site infection (SSI) poses a significant burden of morbidity. While neonates exhibit heightened susceptibility to infections, there is a paucity of data on specific recommendations for perioperative antibiotic prophylaxis during the neonatal period. Our study aimed to assess the impact of prophylactic antibiotic regimen on SSI in neonates.

Materials and Methods: Our retrospective analysis focused on infants undergoing abdominal surgery over a period of one year. SSI, conforming to Centres for Disease Control criteria, was defined as an infection within 30 days of an operative procedure involving the surgical incision's skin, subcutaneous, or deep soft tissues. Perioperative antibiotic prophylaxis, involving the administration of specific antibiotics at surgery's onset to forestall wound infection, was implemented. A formal regimen utilizing cefazolin for abdominal surgery was started, enabling pre-and post-introduction result comparison.

Results: Throughout the study period, 89 abdominal surgeries were performed on newborns, primarily for indications such as intestinal obstruction, congenital abdominal wall defects, and necrotizing enterocolitis. The cohort exhibited a mean gestational age of 33 weeks and a mean birthweight of 1950 g. Antibiotic prophylaxis was administered in 37 episodes, with 78% optimally timed within 60 minutes before surgery. No prophylaxis occurred in 52 episodes. Neonates under pre-operative antibiotics for infection were less likely to receive perioperative antibiotic prophylaxis. Perioperative antibiotic prophylaxis utilization increased significantly after guideline introduction. Incidence rate of SSIs was 16.85 per 100 abdominal surgeries. High SSIs were observed within a week of surgery in infants who did not receive antibiotic prophylaxis.

Conclusion: Despite the existing ambiguity in the literature concerning the risk of SSIs in neonatal surgery, we emphasize the importance of a meticulously tailored antibiotic prophylaxis regimen. The decision to persist in the utilization of cefazolin stems from a judicious evaluation of its efficacy, safety profile, and relevance to the neonatal surgical context.

Keywords: Neonates, Cefazolin, Antibiotic Prophylaxis, Surgical site infection.

Introduction

Surgical Site Infection (SSI) poses a substantial burden on neonatal healthcare, entailing considerable morbidity in this vulnerable population. While neonates are inherently predisposed to infections, the existing body of knowledge concerning perioperative antibiotic prophylaxis in the neonatal period remains limited. Furthermore, recent guidelines have not offered specific recommendations tailored to this critical age group [1,2].

The intricate nature of neonatal physiology and the unique challenges associated with surgical interventions in this population necessitate a nuanced understanding of the role of prophylactic antibiotics in preventing SSIs. In light of the dearth of comprehensive data addressing this specific aspect of neonatal care, there exists a compelling need to investigate and evaluate the impact of perioperative antibiotic prophylaxis on the incidence of SSIs in neonates [3-7].

This retrospective study aims to bridge the existing gap in the literature by delving into the association between prophylactic antibiotics and the occurrence of SSIs in neonates. By scrutinizing the data

pertaining to neonatal surgeries, our investigation seeks to contribute valuable insights that can inform evidence-based practices and potentially influence the formulation of guidelines tailored to the distinctive needs of neonatal surgical care. We aim to shed light on the crucial role of prophylactic antibiotics in mitigating the risk of SSIs in neonates, thereby enhancing the overall quality of care provided to this vulnerable patient population.

Material and Methods

Study Design: This retrospective study aimed to investigate the association between prophylactic antibiotic use and SSI in neonates undergoing abdominal surgery. The study period spanned over a year.

Patient Selection: We conducted a comprehensive review of infants who underwent abdominal surgery within the neonatal unit during the specified timeframe.

Definition of Surgical Site Infection (SSI): SSI was defined according to the criteria established by the Centers for Disease Control, where infection occurrence within 30 days of an operative procedure involving the skin, subcutaneous tissue, or deep soft tissues of the surgical incision constituted an SSI [8].

Definition of Perioperative Antibiotic Prophylaxis: Perioperative antibiotic prophylaxis was characterized by the specific administration of antibiotics at the time of surgery with the primary goal of preventing wound infections.

Introduction of Formal Perioperative Prophylaxis Regimen: A formal perioperative prophylaxis regimen was implemented, involving the use of cefazolin specifically for abdominal surgeries. This introduced a clear demarcation point, allowing for the comparison of results before and after the introduction of the prophylaxis regimen.

This study design and the inclusion of a distinct period for comparison aim to provide valuable insights into the impact of perioperative antibiotic prophylaxis on the occurrence of surgical site infections in neonates undergoing abdominal surgery.

Statistical Analysis: The data gathered was organized into an Excel spreadsheet with the assistance of a statistical expert. Statistical analysis, employing means and standard deviations, was conducted using SPSS 20.00 for Windows (SPSS Inc, Chicago, USA). Group comparisons were evaluated through the unpaired t test, and statistical significance was established at a p-value of less than 0.05.

Results

Throughout the investigation period, a total of 89 abdominal surgeries were conducted on neonates, primarily addressing conditions such as intestinal obstruction, congenital abdominal wall defects, and necrotizing enterocolitis, as outlined in Table 1. Comprehensive details regarding the abdominal surgeries are provided in Table 2.

The cohort under scrutiny demonstrated an average gestational age of 33 weeks and an average birthweight of 1950 g, as delineated in Table 3. Antibiotic prophylaxis was administered in 37 instances, with an optimal timing of 78% occurring within 60 minutes before the commencement of surgery. Notably, there was an absence of prophylaxis in 52 instances. Neonates who were already under pre-operative antibiotic treatment for infection exhibited a decreased likelihood of receiving perioperative antibiotic prophylaxis, as indicated in Table 4. The utilization of perioperative antibiotic prophylaxis experienced a significant increase following the introduction of guidelines. The incidence rate of Surgical Site Infections (SSIs) was recorded at 16.85 per 100 abdominal surgeries. Noteworthy, a higher occurrence of SSIs was observed within the first week post-surgery in infants who did not receive antibiotic prophylaxis, as illustrated in Table 5.

Table 1: Indications of abdominal surgeries in study population

Indication for Surgery	n	%
Intestinal obstruction	25	28.09
Congenital defects in abdominal wall	22	24.72
Necrotizing enterocolitis	18	20.22
Abdominal Mass	9	10.11
Intestinal Perforation	7	7.87
Genitourinary Anomalies	8	8.99

Table 2: Details of abdominal surgeries in study population

Variable	SSI (n = 15)	No SSI (n = 74)	P-value
Day of surgery; Mean ± SD	30.20 ± 32.09	7.48 ± 7.09	0.33
Duration of surgery in minutes; Mean ± SD	110.00 ± 25.45	76.56 ± 17.62	0.08

Table 3: Demographic variables of study population

Variable	SSI (n = 15)	No SSI (n = 74)	P-value
GA in weeks; Mean ± SD	30.00 ± 6.00	34.00 ± 4.58	0.39
Birthweight in grams; Mean ± SD	1390.50 ± 724.34	2170.00 ± 568.77	0.21

Table 4: Antibiotic Prophylaxis in study population

Variable	SSI (n = 15)	No SSI (n = 74)	P-value
Antibiotics given pre-operatively, n (%)	11 (73.33)	61 (82.43)	0.37
Antibiotics given peri-operatively, n (%)	3 (20.00)	34 (45.95)	0.12

Table 5: Infections in study population

Variable	SSI (n = 15)	No SSI (n = 74)	P-value
Sepsis at the time of surgery (Culture positive); n (%)	3 (20.00)	18 (24.32)	0.78
Wound dehiscence; n (%)	6(40.00)	3 (4.05)	0.002

Discussion

The overall incidence of SSI in both adult and pediatric patient populations hovers around 2–5%, and SSIs are linked to heightened morbidity, mortality, increased healthcare expenditures, and prolonged hospital stays [9,10]. Established risk factors for SSI, primarily identified in adult cohorts, encompass advanced age, hyperglycemia, malnutrition, co-morbidities, risk indices, patient frailty, previous infections, surgical complexity, extended operative durations, and elevated blood loss during surgery [11, 12].

In the context of pediatric patients, specific surgical disciplines such as cardiovascular, general surgery, neurosurgery, and orthopedics have been associated with an elevated risk of SSI development [7]. The occurrence of SSI significantly amplifies the clinical and economic burdens associated with surgery, manifesting through prolonged patient hospitalization, the necessity for diagnostic tests, and intensified treatment protocols. Furthermore, SSIs exert a detrimental impact on both the physical and mental health of patients, along with influencing the loss of earnings during the recovery phase [13, 14].

The overall occurrence of SSI in our investigation surpassed previously reported rates for infants and neonates in the existing literature [15-18]. This disparity may be attributed, in part, to our deliberate exclusion of clean cases, wherein a limited rationale exists for prolonged antibiotic usage. Notably, our study population at the highest risk for SSI comprises individuals undergoing re-operation through the same incision and those with a history of preoperative infection.

Factors related to the surgical procedure, such as wound contamination and the duration of the operation, have been well-documented as risk factors for SSI in the broader pediatric population [15-18]. However, the specific impact of perioperative antibiotics on this outcome has not been adequately addressed. Earlier studies aimed to capture preoperative antibiotic use, revealing that in cases of clean surgeries, such use did not significantly alter the incidence of postoperative SSI [17]. Moreover, a randomized control trial found no discernible difference in SSI incidence between infants receiving a single preoperative antibiotic dose and those not receiving any antibiotics for open pyloromyotomy [19]. Furthermore, Breckler et al. [20] examined 118 children undergoing colostomy closure for anorectal malformations. Among them, 66% received antibiotics for 24 hours or less, and 28% received antibiotics for more than 24 hours. Despite an overall SSI incidence of 14%, the limited sample size precluded a definitive determination regarding the impact of prolonged antibiotic duration on SSI incidence.

One constraint of our study lies in the limited sample size. Our patient cohort encompassed various types of surgeries and antibiotic administrations. It was impractical to focus solely on a particular type of operation or to analyze the impact of distinct antibiotics, given the insufficient available data.

Conclusion

While there is uncertainty in the current literature regarding the risk of SSIs in neonatal surgery, we underscore the significance of a carefully customized antibiotic prophylaxis regimen. The choice to continue using cefazolin is based on a thorough assessment of its effectiveness, safety profile, and appropriateness for the specific circumstances of neonatal surgical procedures.

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