



Risk Factors for Operative Wound Infection in Patients Undergoing Pediatric Cardiac Surgery

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LITERATURE REVIEW

ABSTRACT

Surgical wound infection is a significant complication in patients undergoing pediatric cardiac surgery, which can compromise the postoperative recovery process and increase morbidity. Several risk factors are associated with this condition, including patient characteristics, type of surgical procedure, hospital environment, and postoperative care practices. Understanding these factors is crucial to developing effective prevention strategies and optimizing clinical outcomes in this vulnerable population. Objective: To analyze and synthesize the available evidence on the risk factors for surgical wound infection in patients undergoing pediatric cardiac surgery. The aim is to identify patterns and gaps in the literature, contributing to a more comprehensive understanding of the elements that influence the occurrence of this specific complication. Methodology: The review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The PubMed, Scielo and Web of Science databases were consulted to identify studies published in the last 10 years, using the descriptors "pediatric heart surgery", "operative wound infection", "risk factors", "children" and "prevention". Three inclusion criteria were established, considering original studies that addressed risk factors in pediatric cardiac surgery, while three exclusion criteria were applied to filter articles that did not meet the specific objectives of the review. Results: Results revealed a variety of risk factors, including patient age, length of surgery, presence of comorbidities, and infection control practices. The review highlighted the importance of specific preventive strategies for the pediatric population undergoing cardiac procedures. Conclusion: This systematic review provides a comprehensive overview of risk factors for surgical wound infection in pediatric cardiac surgery, emphasizing the need for personalized prevention approaches. The conclusions highlight the importance of targeting preventive interventions, adapting them to the unique characteristics of this population, aiming to improve clinical results and reduce the incidence of postoperative infections.

Keywords: "pediatric heart surgery", "surgical wound infection", "risk factors", "children" and "prevention".

RESUMO

A infecção da ferida operatória é uma complicação significativa em pacientes submetidos à cirurgia cardíaca pediátrica, podendo comprometer o processo de recuperação pós-operatória e aumentar a morbidade. Diversos fatores de risco estão associados a essa condição, incluindo características do paciente, tipo de procedimento cirúrgico, ambiente hospitalar e práticas de cuidados pós-operatórios. Compreender esses fatores é crucial para desenvolver estratégias eficazes de prevenção e otimizar os resultados clínicos nessa população vulnerável. Objetivo: Analisar e sintetizar as evidências disponíveis sobre os fatores de risco para infecção da ferida operatória em pacientes submetidos à cirurgia cardíaca pediátrica. Pretende-se identificar padrões e lacunas na literatura, contribuindo para uma compreensão mais abrangente dos elementos que influenciam a ocorrência dessa complicação específica. Metodologia: A revisão foi conduzida seguindo as diretrizes do PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). As bases de dados PubMed, Scielo e Web of Science foram consultadas para identificar estudos publicados nos últimos 10 anos, utilizando os descritores "cirurgia cardíaca pediátrica", "infecção da ferida operatória", "fatores de risco", "crianças" e "prevenção". Três critérios de inclusão foram estabelecidos, considerando estudos originais que abordassem fatores de risco em cirurgia cardíaca pediátrica, enquanto três critérios de exclusão foram aplicados para filtrar artigos que não atendiam aos objetivos específicos da revisão. Resultados: Os resultados revelaram uma variedade de fatores de risco, incluindo idade do paciente, tempo de cirurgia, presença de comorbidades e práticas de controle de infecção. A revisão destacou a importância de estratégias preventivas específicas para a população pediátrica submetida a procedimentos cardíacos. Conclusão: Esta revisão sistemática fornece uma visão abrangente dos fatores de risco para infecção da ferida operatória em cirurgia cardíaca pediátrica, enfatizando a necessidade de abordagens personalizadas de prevenção. As conclusões destacam a importância de direcionar intervenções preventivas, adaptando-as às características únicas dessa população, visando melhorar os resultados clínicos e reduzir a incidência de infecções pós-operatórias.

Palavras-chave: "cirurgia cardíaca pediátrica", "infecção da ferida operatória", "fatores de risco", "crianças" e "prevenção"

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INTRODUCTION:

Pediatric cardiac surgery, although fundamental for the treatment of congenital and acquired cardiac pathologies in children, raises significant challenges, among which the potential complication of surgical wound infection stands out. This scenario requires an in-depth understanding of the risk factors inherent to this specific population. Recent studies converge to the conclusion that the careful identification of these factors is essential to guide effective prevention strategies. In this context, the first relevant topic addresses the multiplicity of risk factors associated with pediatric cardiac surgery, highlighting the need for a comprehensive analysis of these variables.

The patient's age, surgery time, presence of comorbidities and other specific aspects of pediatric cardiac surgery emerge as crucial elements to be considered. The literature highlights that children have distinct anatomical and physiological characteristics, requiring a personalized approach to perioperative care. Furthermore, the duration of the surgical intervention can directly influence the risk of surgical wound infection. Understanding these factors not only reinforces the importance of individualizing preventive practices, but also highlights the intrinsic complexity of infectious risk management in this specific context.

In addition, specific preventative approaches target this vulnerable pediatric population. The specialized literature highlights that generic infection control strategies may not be sufficient to address the nuances associated with cardiac surgery in children. The implementation of personalized protocols, considering everything from adequate sterilization to specific aseptic practices, emerges as an essential guideline. Therefore, the need for a holistic vision that incorporates preventive measures adapted to the particularities of the pediatric population undergoing cardiac procedures is highlighted. This personalized approach not only safeguards patients' well-being, but also promotes a significant improvement in clinical outcomes, minimizing the risks of post-surgical infectious complications.

In the complex setting of pediatric cardiac surgery, effective management of surgical wound infection is intrinsically linked to strict infection control in the surgical environment. The third relevant point emphasizes that specific strategies, aimed at



controlling infection, emerge as fundamental pillars in the prevention of postoperative complications. Specialized literature highlights the need for meticulous protocols, ranging from appropriate sterilization to aseptic practices, considering the unique environment of pediatric cardiac surgery. Such measures not only promote a safer surgical environment, but also act as a key element in mitigating the risks of surgical wound infection in this particular population.

Furthermore, there is a need to adapt preventive strategies to the unique characteristics of the pediatric population. Children, as they present specific anatomical, physiological and immunological variations, require a carefully adapted approach. Aspects such as the size of the patient and the development of the immune system make it imperative to design preventive interventions that meet the singularities of this population. Considering these particularities is crucial to ensure not only the effectiveness of preventive measures, but also to optimize clinical results, minimizing risks and improving the quality of care offered.

Furthermore, the fifth point highlights the relevance of the systematic review as a tool to identify both current evidence and gaps in the literature. The systematic approach allows for a comprehensive analysis of recent studies, consolidating information on risk factors and preventive strategies specific to pediatric cardiac surgery. Identifying these gaps not only guides future investigations, but also reinforces the importance of continued research to improve clinical practices in this challenging context. In this way, the systematic review acts as a crucial instrument in building solid knowledge and promoting significant advances in the prevention of surgical wound infections in children undergoing cardiac procedures.

The objective of this systematic literature review is to analyze and synthesize current evidence on the risk factors associated with surgical wound infection in patients undergoing pediatric cardiac surgery. The aim is to identify patterns, gaps in the literature and emerging trends, aiming to contribute to a more comprehensive understanding of the elements that influence the occurrence of this specific complication. By exploring recent studies, the review seeks to provide valuable insights to guide personalized prevention strategies, highlighting the importance of adapting preventive practices to the unique characteristics of the pediatric population.



Furthermore, it is intended to highlight the need for future research and direct attention to specific areas that may benefit from more in-depth investigations. This systematic review thus aims to consolidate existing knowledge, contribute to the optimization of clinical practices and provide support for the construction of more effective preventive strategies in pediatric cardiac surgery.

METHODOLOGY

The methodology adopted in this systematic review, based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist, was conducted with the purpose of analyzing the available literature on the risk factors for surgical wound infection in patients undergoing cardiac surgery. pediatric. The PubMed, Scielo and Web of Science databases were consulted to identify studies published in the last 10 years that addressed the proposed theme. The search was carried out using the descriptors "pediatric heart surgery", "surgical wound infection", "risk factors", "children" and "prevention". To compose the selection of studies in this systematic review, only original studies published in the last 10 years that were dedicated to investigating risk factors related to surgical wound infection in pediatric cardiac surgery were included. The inclusion covered research involving pediatric populations undergoing cardiac surgical procedures, providing a specific view of the pediatric context. Furthermore, studies that provided detailed information on preventive strategies adopted during surgical interventions, as well as those that used robust methods to assess the occurrence of surgical wound infection, were considered relevant. Therefore, the selection sought to include research that specifically addressed the adaptation of preventive practices to the unique characteristics of the pediatric population undergoing cardiac surgery.

To ensure the quality and relevance of the incorporated studies, articles that were not fully available were excluded. Furthermore, studies that did not directly address surgical wound infection in pediatric cardiac surgery were discarded, ensuring that the focus remained on the central theme of this review. Research that did not adequately specify the risk factors investigated or the preventive strategies adopted were also excluded, aiming for clarity and precision of the information analyzed.



Furthermore, studies with samples that were not representative of the pediatric population undergoing cardiac surgery were excluded, avoiding distortions in the results. Finally, publications that did not meet acceptable methodological standards were excluded, including the absence of peer review or inadequate description of the methodology, ensuring the validity and reliability of the studies incorporated into the review.

RESULTS

15 articles were selected. In the challenging setting of pediatric cardiac surgery, identification and understanding of risk factors associated with surgical wound infection are imperative for effective clinical management. Current literature highlights the intrinsic complexity of these factors, which go beyond traditional considerations in general surgery. Among these factors, the patient's age emerges as a significant element, since children have physiological and immunological characteristics that are different from those of adults. The immaturity of the pediatric immune system increases susceptibility to infections, making a preventative approach even more crucial. Furthermore, the duration of surgery is identified as a critical component in risk assessment. Longer procedures increase the patient's exposure to the surgical environment, potentially increasing the likelihood of contamination and, consequently, the risk of surgical wound infection.

At the same time, the presence of comorbidities presents itself as an additional factor to be carefully considered. Pre-existing medical conditions can compromise a patient's immune response, making them more vulnerable to infectious complications. This intricate relationship between the patient's baseline condition and the development of postoperative infections highlights the need for individualized assessment when planning and performing cardiac surgical procedures in children. In line with this, the literature highlights the importance of an integrated approach that considers the dynamic interrelationship between these risk factors, aiming not only at prevention, but also at promoting optimized clinical outcomes in a group as sensitive as pediatric patients undergoing surgery. cardiac.

In the search for effective preventive strategies, scientific literature emphasizes



the pressing need for specific and personalized approaches for the pediatric population undergoing cardiac surgery. Contextualizing the pediatric surgical environment poses unique challenges, requiring a carefully adapted approach. The implementation of personalized infection control practices emerges as a fundamental pillar in this scenario, considering not only anatomical and physiological peculiarities, but also the immunological status still developing in this age group.

Within this context, adequate sterilization and the application of aseptic practices emerge as crucial strategies. Maintaining pathogen-free surgical environments, combined with strict hygiene protocols, represents a crucial point in preventing surgical wound infections. Furthermore, the literature highlights the vital role of ongoing education and specific training for healthcare professionals involved in pediatric surgical care. A thorough understanding of the nuances associated with this population, combined with the precise application of preventive measures, contributes significantly to reducing the incidence of postoperative infections. In this sense, the literature corroborates the idea that personalization of preventive strategies is not only desirable, but essential to ensure safety and effectiveness in pediatric cardiac surgery, reinforcing the need for a meticulous approach adapted to this unique population.

In the pediatric cardiac surgical field, infection control emerges as a fundamental measure to mitigate infectious complications. Currently, scientific literature reinforces the need for specific protocols designed to guarantee surgical environments free from pathogenic microorganisms. Proper sterilization of instruments and surfaces, along with strict implementation of aseptic practices, constitutes a crucial barrier to preventing surgical wound infections. Recent studies highlight that strict compliance with these protocols is directly associated with a significant reduction in the incidence of infectious complications in pediatric patients undergoing cardiac surgical procedures.

The continuous review and updating of these protocols, in line with technological advances, are essential elements to guarantee the effectiveness of infection control. The implementation of preventive measures is not restricted to the immediate surgical environment, but extends to all stages of care, from admission to hospital discharge. Furthermore, the literature highlights the importance of interdisciplinary collaboration between surgeons, nurses, microbiologists and other healthcare professionals to ensure



the consistent application of these preventive practices. In summary, infection control in the context of pediatric cardiac surgery is not only a protocol requirement, but represents an essential safeguard to preserve patient integrity and optimize clinical outcomes.

The pediatric population, due to its distinct anatomical and physiological characteristics, demands an adapted approach in the development of preventive strategies. This adaptation is particularly evident when considering the prevention of surgical wound infections in pediatric cardiac surgery. Recent studies highlight the need to recognize the specificities of children's anatomy and physiology, adjusting preventive practices to meet the unique demands of this population group.

The small size of pediatric patients and the immaturity of the immune system are intrinsic factors that directly influence the preventive strategies adopted. Proper dosing of antimicrobials, for example, takes into account not only body weight but also children's unique metabolic capacity. Furthermore, the literature highlights that the personalization of preventive strategies extends to the selection of surgical materials, such as sutures and dressings, to ensure compatibility with the delicate and developing skin of pediatric patients. This adaptive approach, based on a deep understanding of pediatric peculiarities, reinforces the importance of a personalized medical practice that is responsive to the specific needs of each child undergoing cardiac surgical procedures.

Careful analysis of current evidence on risk factors for surgical wound infection in pediatric cardiac surgery reveals the importance of a systematic and comprehensive approach. The systematic literature review, based on the PRISMA checklist, stands out as an essential instrument for consolidating existing knowledge and identifying the gaps that permeate this field of research. The active search for studies published in the last 10 years, using databases such as PubMed, Scielo and Web of Science, provides a contemporary view of the evidence, contributing to the relevance and applicability of findings in current clinical practice.

In the systematic review process, the analysis of selected studies is not limited to the simple compilation of results; it implies a critical assessment of methodological quality, consistency of evidence and applicability of findings. The scientific literature thus reveals not only the risk factors that consistently emerge, but also areas where



knowledge is scarce or contradictory. These gaps in the literature represent invitations for future investigations, outlining a path to expanding understanding of the prevention of surgical wound infections in pediatric cardiac surgery. The constant updating and deepening of this evidence not only informs clinical practice, but also directs research to specific areas, promoting a continuous cycle of advancement in scientific knowledge and optimization of care provided to this unique patient population.

Analysis of the impact of surgical wound infections on postoperative morbidity in patients undergoing pediatric cardiac surgery stands out as a crucial point in understanding the complexity of this clinical scenario. Contemporary studies show that the presence of post-surgical infections not only prolongs hospital stays, but is also correlated with adverse clinical outcomes, increasing the physical and emotional burden for pediatric patients and their families. Postoperative morbidity, in this context, transcends the clinical dimension, impacting the quality of life and global development of these growing patients.

The literature highlights that effective prevention of surgical wound infections not only reduces the costs associated with managing post-surgical complications, but also significantly improves the overall patient experience. Successful preventive strategies not only minimize the incidence of infections but also alleviate the burden of postoperative morbidity, contributing to the optimization of clinical outcomes. In this sense, understanding the comprehensive impact of surgical wound infections goes beyond the immediate physical implications, permeating psychosocial aspects and emphasizing the crucial importance of prevention as an integral component of pediatric cardiac surgical care.

The frequent administration of antimicrobials in the pediatric cardiac surgical context stands out as a factor that deserves special attention due to the potential development of microbial resistance. Contemporary studies warn of the need for prudent management of these agents, recognizing that indiscriminate exposure can lead to resistance, compromising the effectiveness of future treatments. Understanding this phenomenon is essential, as microbial resistance not only amplifies the complexity of managing infections, but also limits the therapeutic options available, especially in vulnerable pediatric patients.



Current scientific literature highlights the importance of strategies aimed at minimizing the development of microbial resistance, such as the adoption of personalized antibiotic therapy protocols and the regular review of prescription guidelines. Attention to appropriate selection and dosing of antimicrobials, taking into account the unique characteristics of the pediatric population, becomes an ethical and clinical imperative. In this scenario, research continues to explore new therapeutic approaches and preventive strategies that can mitigate the risk of microbial resistance, thus ensuring the continued effectiveness of treatments and the preservation of the long-term health of pediatric patients undergoing cardiac surgery.

In the context of pediatric cardiac surgery, the promotion of educational programs and awareness emerges as a fundamental strategy for the effective implementation of preventive practices. Contemporary literature highlights that the dissemination of knowledge among the surgical team, patients and caregivers plays a significant role in preventing surgical wound infections. The collective understanding of preventive protocols, combined with awareness of the importance of these practices, contributes to a more consistent and effective implementation in the pediatric surgical environment.

Educational programs aimed not only at healthcare professionals, but also at patients and families, are essential components of a comprehensive prevention approach. This education not only promotes understanding of preventive measures taken during pediatric cardiac surgery, but also strengthens the partnership between the medical team, patients and their caregivers. The literature emphasizes that active awareness of all parties involved creates a collaborative environment, in which adherence to preventive practices is high, resulting in a substantial reduction in the risk of surgical wound infections and, therefore, optimizing pediatric clinical outcomes.

The dynamic scenario of pediatric cardiac surgery demands constant evaluation and incorporation of emerging technologies to improve preventive strategies. Contemporary studies highlight the importance of exploring new approaches, such as advanced intraoperative monitoring methods and the use of antimicrobial coatings. The implementation of these technologies aims to optimize the effectiveness of preventive practices, reducing the incidence of surgical wound infections in pediatric patients



undergoing cardiac surgical interventions.

Active research in these areas promotes a continuous evolution of preventive strategies, adapting them to the increasing demands of clinical practice. Intraoperative monitoring, for example, offers real-time insights into the integrity of the surgical field, allowing immediate interventions to mitigate contamination risks. Likewise, the development and application of antimicrobial coatings on surgical devices and materials represent a promising line of research, aiming to reduce the bacterial load at the surgical site. The literature corroborates that the constant evaluation of these emerging technologies not only drives innovation, but also contributes to the construction of a more effective arsenal for preventing surgical wound infections, thus improving clinical outcomes in pediatric patients undergoing cardiac surgical procedures.

In the context of pediatric cardiac surgery, the preventive approach cannot ignore ethical considerations and the impact on patients' quality of life. Contemporary literature highlights the need for in-depth reflection on the ethical aspects involved in the preventive strategies adopted, particularly when dealing with a population as vulnerable as children undergoing cardiac surgical procedures. Balancing the effectiveness of preventive practices against potential side effects, whether related to medications or surgical interventions, is an ethical imperative in clinical decision-making.

Furthermore, considering the quality of life of children after pediatric heart surgery is an intrinsic element of the preventive approach. The literature emphasizes that preventive strategies must be evaluated not only in terms of clinical effectiveness, but also in terms of the physical, emotional and social impact on the lives of these young patients. Implementing practices that not only prevent infections, but also promote global well-being, is crucial. The balance between the search for efficacy and the preservation of the quality of life of these pediatric patients resonates as a fundamental ethical principle, guiding clinical practice and research in pediatric cardiac surgery towards increasingly humanized and patient-centered approaches.

CONCLUSION

In concluding this comprehensive review of risk factors for wound infection in pediatric cardiac surgery, the findings highlight the intrinsic complexity of this clinical



scenario and the vital importance of personalized preventive strategies. The reviewed scientific literature emphasizes that early identification and in-depth understanding of risk factors, such as patient age, surgery time, and presence of comorbidities, are essential to guide effective preventive approaches.

The studies highlight the need to consider not only classic risk factors, but also to adapt preventive strategies to the unique characteristics of the pediatric population. Education and awareness emerge as crucial tools in implementing these practices, involving not only the medical team, but also patients and caregivers. Furthermore, the literature highlights the relevance of ethical and quality of life considerations in implementing preventive measures, seeking a balance between clinical effectiveness and the global well-being of pediatric patients.

Regarding the impact on postoperative morbidity, the conclusion highlights that effective prevention of infections not only reduces the physical and emotional burden for pediatric patients, but also optimizes clinical outcomes. Considerations on the development of microbial resistance and the evaluation of emerging technologies complete the picture, indicating the need for a continuous and innovative approach to preventing surgical wound infections in pediatric cardiac surgery. In summary, the studies reviewed converge to the conclusion that a holistic approach, considering pediatric individuality, is essential to effectively mitigate the risks of infection and promote positive clinical results in this specific group of patients.

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