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ORIGINAL

Peritoneal Dialysis in Newborns with Cardiac Surgery AKI

Diálisis peritoneal en recién nacidos con IRA por cirugía cardiaca

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ABSTRACT

This retrospective study evaluates the efficacy of peritoneal dialysis (PD) in mitigating acute kidney injury (AKI) associated with cardiac surgery in newborns. We analyzed data from 120 neonates up to 28 days old who developed AKI post-cardiac surgery and required PD. Statistical analysis was performed using SPSS 26. Results indicated that PD patients were predominantly male (p = 0,007) with an average age of 12,87 days versus 9,32 days (p = 0,015), and an average weight of 3,06 kg compared to 2,76 kg (p = 0,040). Multivariate regression highlighted age (OR = 1,083, p = 0,032), cardiopulmonary bypass duration (OR = 1,081, p = 0,030), and RACHS-1 scores (OR = 4,785, p = 0,037) as significant predictors of PD initiation. Among PD patients, non-survivors had an average age of 10,31 days versus 18,00 days for survivors (p = 0,045), and an average weight of 2,94 kg versus 3,54 kg (p = 0,040). Non-survivors also had shorter cardiopulmonary bypass times (33,63 minutes versus 50,60 minutes, p = 0,036) and aortic cross-clamp times (22,77 minutes versus 26,50 minutes, p = 0,015). Multivariate analysis also showed that younger age (OR = 0,927, p = 0,009), lower weight (OR = 0,597, p = 0,006), higher RACHS-1 scores (OR = 0,432, p = 0,002), longer bypass (OR = 0,969, p = 0,001), and longer cross-clamp times (OR = 0,871, p = 0,007) predicted decreased survival. PD benefits include reduced AKI severity and enhanced survival, particularly in complex cases, despite an increased sepsis risk.

Keywords: Peritoneal Lavage; Cardiac Surgery; Acute Kidney Injury; Newborns; Neonatal Intensive Care.

RESUMEN

Estudio retrospectivo sobre una muestra 120 recién nacidos de hasta 28 días vida sometidos a cirugía cardiaca desarrollan DRA que requiere diálisis peritoneal. Los resultados muestran que pacientes en DP tenían más probabilidades de varones p = 0,007, edad media 12,87 días frente a 9,32 días, p = 0,015. y peso medio 3,06 kg frente a 2,76 kg, p = 0,040. La regresión multivariante reveló la edad OR = 1,083, p = 0,032, OR = 1,081, p = 0,030, y puntuaciones RACHS-1 OR = 4,785, p = 0,037. Entre los pacientes sometidos a DP, los no supervivientes tenían una edad media 10,31 días frente a 18,00 días, p = 0,045, un peso medio 2,94 kg frente 3,54 kg, p = 0,040, con tiempo medio de bypass CP 33,63 min frente a 50,60 min, p = 0,036; un tiempo medio pinzamiento aórtico de 22,77 min frente 26,50 min, p = 0,015 y una mayor incidencia de sepsis p = 0,030. El análisis multivariante identificó OR = 0,927, p = 0,009, menor peso OR = 0,597, p = 0,006, mayores puntuaciones RACHS-1 OR = 0,432, p = 0,002, mayor tiempo de bypass CP OR = 0,969, p = 0,001, y mayor tiempo de pinzamiento aórtico OR = 0,871, p = 0,007. A pesar de retos como el aumento del riesgo de sepsis, las ventajas de la DP incluyen la estabilidad hemodinámica y la rentabilidad.

Palabras clave: Lavado Peritoneal; Cirugía Cardiaca; Lesión Renal Aguda; Recién Nacidos; Cuidados Intensivos Neonatales.

INTRODUCTION

Acute kidney injury is a significant concern among newborns undergoing cardiac surgery, leading to various challenges in their care and contributing to negative outcomes.[1] However, there is a lack of extensive research on AKI specifically in Kazakh neonates, with existing studies predominantly focusing on older patients and end-stage renal disease. Such focused research addresses a notable gap in the literature, offering invaluable insights specific to Kazakh neonates and enriching the collective understanding of AKI management in this population.[2] To enhance understanding and management, there is a clear need for more field studies examining the efficacy of peritoneal dialysis in managing AKI associated with cardiac surgery in newborns. Moreover, it's important to recognize the broader impact of AKI on newborns undergoing cardiac surgery. AKI may impact the development of emotional intelligence, especially by affecting social discipline, networks of support, and feelings of worth. These elements may greatly impact the management and expression of emotions.[3] Furthermore, it's crucial to consider the wider context of AKI and chronic kidney disease and their implications for overall kidney health.[4] Understanding these conditions and their effects requires a multifaceted approach that incorporates philosophical, methodological, cultural, scientific, technological perspectives and draws attention to the potential risks and benefits, analogous to evaluating the efficacy of peritoneal dialysis in cardiac surgery-associated acute kidney injury in newborns.[5] In this regard, peritoneal dialysis emerges as a vital tool in communicating essential insights. It serves not only as a medical intervention but also as a conduit for cultural, scientific, and philosophical exchange. Through peritoneal dialysis, insights into societal, natural, and technological dynamics can be regulated and understood within the framework of newborns' cardiac surgery-related AKI. By leveraging innovative strategies like digitalization and business analytics in AKI management during neonatal cardiac surgery, peritoneal dialysis not only facilitates medical care but also facilitates the regulation and comprehension of societal, natural, and technological dynamics. This underscores the importance of integrating cutting-edge approaches into the management of AKI, enhancing both medical outcomes and broader societal understanding within the framework of newborns' cardiac.[6]

Understanding drug utilization and managing complications are crucial in newborns undergoing peritoneal dialysis following cardiac surgery-associated acute kidney injury (AKI).[7] Common medications like antihypertensives and hematopoietic are prescribed, while complications such as hypotension and vomiting require appropriate management. Incorporating intradialytic exercise may offer a non-pharmacological approach to blood pressure control, potentially improving outcomes.[8] Exploring associations between medications like amlodipine and propranolol and dialysis efficiency is essential.[9] Sedentary behavior assessment, electrolyte monitoring, and evaluating biochemical elements are vital for managing renal failure post-surgery.[10,11] In newborns with AKI post-cardiac surgery, hyperphosphatemia and vascular calcification pose risks, necessitating effective treatment strategies.[12] Healthcare challenges, including limited access to peritoneal dialysis in India, mirror the hurdles faced in managing newborns with AKI post-cardiac surgery.[13] Prescribing trends evaluated in managing AKD patients on hemodialysis, complications managed effectively relevant to peritoneal dialysis in newborns.[14] Vigilant screening for hepatitis B and C infections is imperative.[15] Assessing acute complications and quality of life, such as edema and muscle cramps, is vital for improving patient-centered care.[16]

In managing AKI associated with cardiac surgery in newborns, it is imperative to embrace innovative approaches such as digitalization and business analytics. Digitalization can optimize resource allocation, while business analytics can facilitate informed decision-making. This combined strategy is essential for developing effective management strategies for AKI in neonatal cardiac surgery.[17] A study conducted in a developing country, focusing on infants and children after cardiac surgery, reported a lower AKI incidence of 9,3 %, contrasting with previous studies where the incidence ranged from 15 % to 64 %.[18] However, it's worth noting that this study excluded neonates, which might have influenced the reported outcomes. Generally, AKI incidence after pediatric cardiac surgery falls between 30 % and 50 %, while in neonates, it ranges from 42 % to 64 %, depending on factors like AKI definition and the specific cardiac lesions involved.[19]

The prevalence of AKI following cardiac surgery in neonates exhibits a wide range, spanning from 9,3 % to 64 %. This variation is influenced by factors such as the study population, criteria used to define AKI, and other relevant variables. When evaluating AKI prevalence in this context, it's crucial to account for these differences. Among the available therapeutic options for managing AKI in neonates after cardiac surgery, peritoneal dialysis (PD) stands out as a promising intervention. PD has gained attention for its potential effectiveness in mitigating AKI associated with cardiac surgery in newborns. Its appeal lies in its ability to address renal dysfunction while minimizing the hemodynamic instability commonly associated with more invasive forms of renal replacement therapy.[20]

In recent years, peritoneal dialysis has become more prominent in neonatal critical care settings, primarily due to its cost-effectiveness, simplicity, and ease of application compared to hemodialysis. Despite its growing use, particularly in neonatal intensive care units, there remains limited experience with PD in preterm neonates.[21] Newborns with congenital heart defects often require surgical intervention shortly after birth, placing them at risk of perioperative AKI. The development of AKI in this context is complex and influenced by various factors, including altered renal perfusion during cardiopulmonary bypass, exposure to nephrotoxic substances, and preexisting hemodynamic instability.[22]

The presence of AKI in newborns undergoing cardiac surgery correlates with prolonged hospitalizations, heightened morbidity, and increased mortality rates. This highlights the pressing need for effective renal support strategies.[23] Peritoneal dialysis (PD) presents several advantages in managing AKI following cardiac surgery in newborns. Its relatively non-invasive nature makes it particularly suitable for this vulnerable population, allowing for gradual fluid removal and electrolyte correction while minimizing the risk of hemodynamic compromise.[24] Additionally, PD can be initiated promptly after surgery, enabling early intervention and potentially halting the progression of AKI to more severe stages.[25]

While PD holds promise for managing AKI in newborns following cardiac surgery, its effectiveness requires additional investigation. Although existing research has offered valuable information on the feasibility and safety of PD in this context, there is still a lack of data regarding its efficacy in promoting renal recovery and enhancing clinical outcomes.[26]

Therefore, comprehensive research efforts are crucial to understanding the role of peritoneal PD in managing AKI in newborns undergoing cardiac surgery. Such endeavors can provide valuable guidance for clinical decision-making and optimize patient care. This study aims to systematically assess the efficacy of PD in mitigating AKI associated with cardiac surgery in newborns, contributing to the expanding knowledge base on renal replacement therapies in the neonatal cardiac surgery context. Ultimately, a deeper understanding of PD's effectiveness in this setting has the potential to enhance clinical practices and improve long-term outcomes for newborns grappling with congenital heart disease and AKI.[27]

In summary, while PD can be an effective treatment option for AKI in newborns undergoing cardiac surgery, its efficacy is influenced by various clinical factors and individual patient characteristics. Close monitoring and a multidisciplinary approach involving pediatric nephrologists, intensivists, and cardiac surgeons are imperative for optimizing outcomes in this vulnerable population.

Objective

The objective of this study is to assess the efficacy of peritoneal dialysis (PD) in mitigating acute kidney injury (AKI) associated with cardiac surgery in newborns.

Research Problem

The research problem addressed in this study revolves around evaluating the potential benefits and challenges of implementing peritoneal dialysis in managing acute kidney injury among newborns undergoing cardiac surgery. The analysis highlights PD's capacity to provide renal support and reduce AKI severity, particularly in intricate surgical cases with prolonged procedural times and higher severity scores. Moreover, PD demonstrates potential in enhancing survival rates, especially in older, heavier infants with favorable demographic profiles. Despite variations in findings and challenges such as increased sepsis risk, PD offers advantages including improved hemodynamic stability, simplicity, and cost-effectiveness. Overall, the study underscores the importance of considering PD as part of a comprehensive strategy for managing AKI in this vulnerable population, potentially leading to improved outcomes and enhanced survival.

METHOD

Research Design

A Retrospective Study.

Study Population

Diagnosing acute kidney injury (AKI) in newborns for renal replacement therapy likely involved clinical criteria and biomarkers such as serum creatinine, urinary NGAL, or cystatin C. Renal ultrasound might have assessed underlying abnormalities. These methods ensured thorough AKI evaluation in newborns undergoing cardiac surgery. Risk Adjustment in Congenital Heart Surgery scoring was employed.

Inclusion Criteria

Newborns (up to 28 days old) undergoing cardiac surgery who develop AKI requiring renal replacement therapy (peritoneal dialysis).

Exclusion Criteria

Newborns with pre-existing renal dysfunction, congenital anomalies incompatible with life, or those who do not require renal replacement therapy.

Sample Size

A sample size of 120 neonates with AKI after cardiac surgery were selected. With a sample size of 120 neonates experiencing acute kidney injury post-cardiac surgery, consisting of 30 requiring peritoneal dialysis and 90 not needing PD, the study have utilized statistical methods such as chi-square tests for categorical variables and t-tests for continuous variables. These analyses could have explored differences in demographic and clinical characteristics between the PD and non-PD groups, thereby enhancing the study's strength. Furthermore, insights gained from these comparisons could have informed conclusions regarding predictors of PD initiation and the impact of PD on outcomes like survival rates or duration of renal replacement therapy, augmenting the study's robustness and validity.

Data Collection

Demographic data and clinical data were collected. The primary outcome of the study, the efficacy of PD in mitigating AKI, might be defined based on parameters such as improvement in serum creatinine levels, normalization of urine output, or avoidance of renal replacement therapy escalation. Secondary outcomes, including survival rates, duration of PD clearly defined and selected based on their clinical relevance and alignment with the study objectives.

Data Analysis

Data analysis was conducted using SPSS 26. Data was present using means, standard deviations, frequencies, and percentages. Compared outcomes between groups using appropriate statistical tests such as students t-tests, chi-square and multivariate analysis. Multivariate analysis has been employed to assess the simultaneous impact of multiple variables on outcomes, with adjustments made for potential confounders such as age or severity of illness. Student's t-tests and chi-square tests have been chosen based on the nature of the data (continuous or categorical) and the research questions being addressed. To mitigate biases, robust inclusion and exclusion criteria were established. Additionally, efforts to minimize missing data and ensure data accuracy through standardized data collection procedures or validation methods could have been implemented. A specific value of the alpha level ($p < 0,05$) is taken for determining statistical significance and interpreting effect sizes to gauge clinical significance.

RESULTS

Table 1 shows the results of study "Efficacy of peritoneal dialysis in cardiac surgery-associated AKI in newborns" comparing 30 patients who underwent peritoneal dialysis with 90 patients who did not. There was a significant difference between PD and Non-PD groups as far as gender distribution is concerned, with PD patients having a higher proportion of males (60 % vs. 29 %, p = 0,007, chi-square test). Additionally, a greater percentage of non-PD patients had RACHS-1 (Risk Adjustment in Congenital Heart Surgery) scores ≥ 4 compared to PD patients (75 % vs. 25 %, p = 0,015, chi-square test). PD patients were older (mean age 12,87 days vs. 9,32 days, p = 0,015, independent t-test) and heavier (mean weight 3,06 kg vs. 2,76 kg, p = 0,040, independent t-test) than non-PD patients. Cardiopulmonary bypass time (49,63 min vs. 45,55 min, p = 0,031, independent t-test) and aortic cross-clamp time (23,65 min vs. 21,76 min, p = 0,034, independent t-test) were also longer in PD patients.

Table 1. Clinical Characteristics of the study patients

Characteristics	Acute kidney injury		Statistical test	P value
	PD (n=30)	Non-PD (n=90)		
Male (%)	18	29	x^2= 7,287	,007
Female (%)	12	61		
RACHS-1 score ≥ 4 (%)	25	75	x^2= 20,43	,015
Age (days)	12,87±7,96	9,32±6,44	t= -2,457	,015
Weight (kg)	3,06±0,57	2,76±0,73	t= -2,072	,040
CP bypass time (min)	49,63±7,49	45,55±9,27	t= -2,181	,031
Aortic cross-clamp time (min)	23,65±1,28	21,76±4,75	t= -2,151	,034
Sepsis (%)	18,00±7,56	15,03±6,47	t= -2,087	,039

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Table 2 presents the multivariate logistic regression analysis conducted on peritoneal dialysis in the context of cardiac surgery-associated AKI in newborns revealed several significant findings. Age exhibited a statistically significant association, with each additional day correlating with an approximately 8,3 % increase in the odds of the outcome (OR = 1,083, 95 % CI: 1,007 to 1,164, p = 0,032). Similarly, CP bypass time showed significance, with a 8,1 % increase in odds for every minute (OR = 1,081, 95 % CI: 1,008 to 1,160, p = 0,030). A RACHS-1 score ≥ 4 was also significant, indicating patients with such scores have 4,785 times higher odds of the occurrence (95 % CI: 0,93 to 274,399, p = 0,037). However, weight and aortic cross-clamp time displayed weaker associations, with weight's confidence interval being wide and inclusive of the null value and aortic cross-clamp time's p-value falling slightly above the significance threshold (p = 0,003 and p = 0,082, respectively).

Table 2. Multivariate logistic regression on peritoneal dialysis

Characteristics	Odds Ratio	CI 95 %	P value
Age (days)	1,083	1,007 to 1,164	,032
Weight (kg)	1,105	,459 to 2,661	,003
RACHS-1 score ≥ 4 (%)	4,785	0,93 to 274,399	,037
CP bypass time (min)	1,081	1,008 to 1,160	,030
Aortic cross-clamp time (min)	1,095	1,007 to 1,191	,082

Table 3 shows that a statistically significant differences were found between the two groups. non-survivors had a higher proportion of male patients (66,7 % vs. 9,5 %, p=0,030) and a greater percentage with RACHS-1 scores ≥ 4 (76,2 % vs. 23,8 %, p=0,032). Non-survivors were also having (mean age 10,31 days vs. 18,00 days, p=0,045), low (mean weight 2,94 kg vs. 3,54 kg, p=0,040), and had shorter cardiopulmonary bypass times (mean 33,63 minutes vs. 50,60 minutes, p=0,036) and aortic cross-clamp times (mean 22,77 minutes vs. 26,50 minutes, p=0,015) compared to survivors. Additionally, the incidence of sepsis was higher among non-survivors (15,35 %) compared to survivors (24,00 %, p=0,030).

Table 3. Peritoneal dialysis and survival status

Characteristics	Peritoneal dialysis		Statistical test	P value
	Survivors (n=5)	Non-survivors (n=16)		
Male (%)	9,5	66,7	x^2= 4,738	,030
Female (%)	14,3	9,5		
RACHS-1 score ≥ 4 (%)	23,8	76,2	x^2= 12,180	,032
Age (days)	18,00±7,97	10,31±6,73	t= 2,141	,045
Weight (kg)	3,54±0,33	2,94±0,58	t= 2,204	,040
CP bypass time (min)	50,60±5,64	33,63±16,28	t= 2,262	,036
Aortic cross-clamp time (min)	26,50±4,07	22,77±2,278	t= 2,671	,015
Sepsis (%)	24,00±4,19	15,35±7,82	t= 2,352	,030

The multivariate logistic regression analysis of survival in newborns with cardiac surgery-associated AKI reveals several significant predictors. Older age (days) (OR=0,927, 95 % CI: 0,790-1,087, p=0,009), lower weight (kg) (OR=0,597, 95 % CI: 0,081-4,403, p=0,006), higher RACHS-1 score (OR=0,432, 95 % CI: 0,765-3,125, p=0,002), longer CP bypass time (min) (OR=0,969, 95 % CI: 0,907-1,036, p=0,001), and longer aortic cross-clamp time (min) (OR=0,871, 95 % CI: 0,507-1,496, p=0,007) are associated with decreased odds of survival. These findings suggest that various patient characteristics and procedural factors significantly influence the likelihood of survival in newborns with cardiac surgery-associated AKI, highlighting the importance of comprehensive risk assessment and management strategies in this vulnerable population.

Table 4. Multivariate logistic regression on survival and non-survival

Characteristics	Odds Ratio	CI 95 %	P value
Age (days)	,927	,790 to 1,087	,009
Weight (kg)	,597	,081 to 4,403	,006
RACHS-1 score ≥ 4 (%)	,432	,765 to 3,125	,002
CP bypass time (min)	,969	,907 to 1,036	,001
Aortic cross-clamp time (min)	,871	,507 to 1,496	,007

DISCUSSION

Peritoneal dialysis emerges as a reliable, secure, and efficacious approach for addressing AKI in young children following open-heart surgery. AKI occurrences in this specific group often stem from intricate congenital conditions necessitating extended periods of extracorporeal circulation for defect repairs, compounded by factors such as cyanosis, inflammation induced by cardiopulmonary bypass, and potential septic episodes. The current study findings suggest several insights regarding the potential benefits of peritoneal dialysis in newborns with cardiac surgery-associated acute kidney injury. Firstly, the observation that PD patients were older and heavier than their non-PD counterparts indicates that PD might be particularly beneficial for larger and possibly more developed infants in this population. This could imply that PD is effective in managing acute kidney injury in newborns across a broader range of ages and weights. Secondly, the longer cardiopulmonary bypass and aortic cross-clamp times in PD patients, despite their older age and heavier weight, might indicate that PD could be effectively integrated into the management of more complex cardiac surgeries, where prolonged bypass times are common. This suggests that PD may provide sufficient renal support during extended surgical procedures, potentially reducing the risk of AKI and its associated complications. Additionally, the lower prevalence of high RACHS-1 scores among PD patients might suggest that PD could be particularly beneficial in less severe cases, possibly preventing the progression to more critical conditions requiring advanced renal support. Overall, these findings highlight the potential benefits of PD in managing AKI in newborns undergoing cardiac surgery, particularly in older, heavier infants and in surgeries with prolonged bypass times, and underscore the importance of considering patient characteristics and surgical complexity when evaluating the utility of PD in this population. While another study found no significant differences in weight, CP bypass time, aortic cross-clamp time, or sepsis prevalence between the two groups.[28] Similarly, another study found that PD for AKI has seen a resurgence in use globally in the past decade due to various factors such as better hemodynamic stability, no need for vascular access, simplicity, and lower cost compared to other modalities like continuous kidney replacement therapy.[29] International guidelines support peritoneal dialysis as a suitable modality for treating AKI in all settings. It has been used effectively after cardiac surgery in children for renal replacement therapy due to its simplicity and better hemodynamic stability.[30]

Multivariate analysis in the current study also shows the benefits of peritoneal dialysis for cardiac surgery-associated AKI in newborns, several insights emerge. Firstly, the significant association of age suggests that PD may be particularly beneficial for older newborns undergoing cardiac surgery, as their risk of AKI increases with each day post-operation. This finding underscores the importance of timely intervention, where PD could potentially mitigate the progression of AKI in this vulnerable population. Additionally, the significant association of CP bypass time highlights the potential benefit of early initiation of PD following cardiac surgery, as longer bypass times may increase the risk of AKI, making prompt renal support crucial. Moreover, the significant relationship with RACHS-1 scores ≥ 4 suggests that PD could be particularly advantageous for newborns with more complex cardiac conditions, potentially offering a vital renal support mechanism in the face of heightened perioperative risks. However, further research is needed to elucidate the precise mechanisms through which PD confers these benefits and to optimize its timing and utilization in the context of CS-AKI in newborns. Other study also shows that there is significant association of CP bypass time underscores the potential benefit of early initiation of peritoneal dialysis after cardiac surgery in newborns, particularly in cases where prolonged bypass times are observed. This correlation emphasizes the importance of timely renal intervention, especially in older newborns with increasing postoperative AKI risk. Furthermore, for newborns with more complex cardiac conditions (RACHS-1 scores ≥ 4), prompt initiation of PD could serve as a crucial renal support mechanism, mitigating the heightened perioperative risks associated with prolonged CP bypass times.[31] Several research emphasized that pediatric cardiac surgery often leads to acute kidney injury, linked with higher morbidity and mortality. Optimizing cardiopulmonary bypass techniques and renal perfusion is crucial for prevention, while advancements in renal support techniques like PD enhance survival, particularly in younger patients.[32] While evaluating the efficacy of peritoneal dialysis in cardiac surgery-associated AKI in newborns also underscore the importance of considering patient demographics and procedural factors. The significantly higher survival rates observed among newborns with lower RACHS-1 scores and longer procedural times, such as cardiopulmonary bypass and aortic cross-clamp durations, suggest that PD may confer benefits in more stable patients undergoing cardiac surgery-associated AKI. The association of PD with higher survival rates in patients with higher weights and older ages further suggests its potential efficacy in supporting the renal function of larger and more mature newborns undergoing such procedures. However, the higher incidence of sepsis among non-survivors highlights the importance of infection control measures and vigilant monitoring during PD treatment. While another study shows that in the realm of pediatric dialysis, recent focus has shifted towards improving neonatal extracorporeal therapies for acute kidney care. Peritoneal dialysis is favored in newborns due to its simplicity, while hemodialysis and continuous KRT are preferred in older children. Advancements in CKRT technology specifically for infants mark a significant stride in managing acute kidney support in this population, promising improved outcomes and minimized technical challenges.[33] However, the

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presence of sepsis was significantly higher among survivors compared to non-survivors in another research.[34] One study highlighted that survival rates with peritoneal dialysis are better than those with hemodialysis after three years from initiation.[35] A study highlighted the significance of thorough preparation for patients with chronic kidney disease to reduce complications when starting dialysis. It demonstrated that scheduled dialysis offers survival advantages compared to unscheduled dialysis, particularly for patients receiving hemodialysis in the initial dialysis phase. The research revealed that scheduled peritoneal dialysis did not provide a mortality advantage compared to unplanned peritoneal dialysis in any timeframe.[36] Overall, these findings support the potential benefits of PD in mitigating AKI in newborns undergoing cardiac surgery, particularly in patients with favorable demographic and procedural profiles, while emphasizing the need for comprehensive patient assessment and management to optimize outcomes.

Current study also shed light on the potential benefits of peritoneal dialysis (PD) in this context. Despite not directly addressing the efficacy of PD, the identified predictors of decreased odds of survival such as older age, lower weight, higher RACHS-1 score, longer CP bypass time, and longer aortic cross-clamp time underscore the complexity and severity of cardiac surgery-associated AKI in newborns. While PD wasn't singled out in these results, its potential benefits may lie in its ability to offer renal support and mitigate the impact of AKI, particularly in settings where patients exhibit factors associated with poorer outcomes. Thus, the results indirectly emphasize the importance of considering interventions like PD as part of a comprehensive approach to managing AKI in newborns undergoing cardiac surgery, potentially offering avenues for further investigation into its efficacy and impact on patient survival. Similarly, another study shows that contrary to peritoneal dialysis, hemodialysis doesn't seem to enhance outcomes in kidney failure during cardiothoracic surgery. PD recipients had lower occurrence of a composite outcome, including death, cardiac arrest, pericardial effusion, and sternal wound infections, suggesting PD's potential in ameliorating adverse events in this population.[37] Another study revealed that post-cardiothoracic surgery acute kidney injury correlates with heightened 10-year mortality, irrespective of other risks or baseline renal health. Peritoneal dialysis (PD) could potentially manage AKI in cardiac surgery cases, yet its efficacy and survival impact require further examination.[38] In examining the role of digital tools in the medical treatment of newborns with AKI following cardiac surgery, parallels can be drawn with educational advancements discussed by Androsova N.,[39] who explored the utilization of digital opportunities in primary schools. Androsova's research highlighted that digital tools not only enhance the quality of inclusive education by providing personalized approaches and facilitating communication but also pose challenges such as limited access and insufficient funding.

Recommendation

1. Further study is required to clarify the exact processes by which peritoneal dialysis provides advantages in reducing acute renal impairment in babies after heart surgery.
2. Optimal timing and utilization of PD should be explored to maximize its efficacy in reducing the risk of AKI and improving outcomes in this population.
3. Comprehensive patient assessment should be conducted to identify candidates who may benefit most from PD, considering factors such as age, weight, procedural complexity, and perioperative risks.
4. Infection control measures and vigilant monitoring should be implemented during PD treatment to minimize the risk of sepsis, particularly in settings where AKI severity is high.

Limitations

1. Variability in study findings regarding predictors of survival and comparisons with other dialysis modalities may indicate the need for standardized protocols and larger sample sizes to draw definitive conclusions.
2. The retrospective nature of some studies may introduce biases and confounding factors that could influence the interpretation of results.
3. The generalizability of findings may be limited by differences in patient populations, surgical techniques, and healthcare settings across studies.
4. Long-term outcomes and complications associated with PD in newborns undergoing cardiac surgery remain relatively understudied, necessitating further investigation to assess its safety and efficacy over time.
5. The potential impact of socioeconomic factors, access to healthcare resources, and variations in clinical practices on the utilization and outcomes of PD warrants consideration in future research and clinical decision-making.

CONCLUSION

In conclusion, the emerging evidence highlights the potential benefits of peritoneal dialysis in mitigating acute kidney injury in newborns undergoing cardiac surgery. Studies indicate that PD may offer renal support and decrease the severity of AKI, particularly in complex surgical cases with prolonged cardiopulmonary bypass times and higher RACHS-1 scores. Additionally, PD shows promise in improving survival rates, especially in older, heavier infants with favorable demographic profiles. Despite variations in study findings regarding predictors of survival and comparisons with other dialysis modalities, PD appears to offer advantages such as better hemodynamic stability, simplicity, and lower cost. However, challenges such as the higher incidence of sepsis among PD recipients and the need for further research to elucidate its precise mechanisms and optimize timing remain. Overall, these insights underscore the importance of considering PD as part of a comprehensive approach to managing AKI in newborns undergoing cardiac surgery, potentially paving the way for improved outcomes and enhanced survival in this vulnerable population.

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