

Original article:

Study of complications during Short Term Hemodialysis with Acute Kidney Injury

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Abstract:

Background: Acute kidney injury (AKI) is a severe condition necessitating short-term hemodialysis (HD) in some cases. However, HD is not without complications, which can impact patient outcomes. This study aims to investigate the complications associated with short-term HD in patients with AKI.

Methods: A retrospective analysis was conducted on 64 patients with AKI who underwent short-term HD. Data on patient demographics, ventilator support, and HD complications were collected. The association between complications and vascular access types was also assessed. Statistical analyses were performed using the Pearson chi-square test.

Results: Among the 64 patients, 34.4% required ventilator support. The most common complications during HD were hypotension (51.6%), vomiting (28.1%), and fever with rigors (26.6%). Premature termination, system clotting, bleeding from operative wound, and dialysis disequilibrium syndrome were less frequently observed. Vascular access complications were present in 31.3% of patients, with catheter clotting being the most common (15.6%). No significant association was found between complications and vascular access types.

Conclusion: Complications during short-term HD in AKI patients are common and can impact patient outcomes. Hypotension was the most prevalent complication, followed by vomiting and fever with rigors. Catheter clotting was the main vascular access-related complication. Close monitoring, proactive intervention, and infection control practices are essential to mitigate these complications and improve patient care. Further research with larger sample sizes is warranted to validate these findings.

Keywords: acute kidney injury, hemodialysis, complications, hypotension, vomiting, fever, ventilator support, vascular access.

Introduction:

Acute kidney injury (AKI) is a severe condition characterized by a rapid decline in kidney function, resulting in the accumulation of waste products and toxins in the body. It is a critical medical condition that requires prompt intervention to prevent further complications and restore renal function. One of the most common treatment modalities for AKI is short-term hemodialysis (HD), which involves the extracorporeal removal of waste products and excess fluids using a dialysis machine.¹

While short-term hemodialysis is an essential intervention for patients with AKI, it is not without potential complications. The process of hemodialysis itself, although life-saving, can introduce various challenges and adverse events, which can impact the patient's overall prognosis. It is crucial for healthcare professionals to be aware of these complications to ensure early recognition, prompt management, and improved patient outcomes.^{2,3}

This study aims to explore the complications associated with short-term hemodialysis in patients with acute kidney injury. By analyzing a range of potential complications, such as hypotension, infections, electrolyte imbalances,

access-related problems, and cardiovascular events, we seek to enhance our understanding of the risks and challenges associated with this treatment modality.^{4,5,6} Additionally, we aim to identify potential risk factors and preventive strategies that can help mitigate these complications, leading to improved patient safety and care.

Material and methods:

The study was undertaken at our medical college under department of Medicine. This was an observational study carried out for 64 patients, suffering from Acute Kidney Injury requiring Short Term Hemodialysis, with presentations of wide variety of medical and surgical disorders necessitating admission in intensive care unit. Duration of study was 2 years, from January 2011 to December 2012.

The patients were included in the study group after considering following inclusion and exclusion criteria.

Inclusion criteria

1. Patients admitted in intensive care unit due to the following reasons
2. Age above 12 years including male and female.
3. Patients with Acute Kidney Injury due to any presentation with or without uremic presenting complaints correlated with biochemical and radiological investigations.

Exclusion criteria

1. Patients of chronic kidney disease on regular dialysis.
2. Acute deterioration in patients with chronic stable renal failure.
3. Age less than 12 years.

Results:

Out of 64 patients, 48 (75%) patients were male whereas 16 (25%) were female, i.e. in this study there was 3:1 ratio of male to female.

Table 1) Showing need of Ventilator support in patients of Acute Kidney injury

| Ventilator support | Number | % |
|--------------------|--------|-------|
| Yes | 22 | 34.4% |
| No | 42 | 65.6% |
| Total | 64 | 100% |

The above table shows that ventilator support was required in 22(34%)out of total 64 patients.

Table 2) Showing complications of Hemodialysis (HD) in our study

| Complications in HD | Number | % |
|----------------------------------|--------|-------|
| Hypotension | 33 | 51.6% |
| Vomiting | 18 | 28.1% |
| Fever with rigors | 17 | 26.6% |
| Premature termination | 6 | 9.4% |
| System clotted | 4 | 6.25% |
| Bleeding from operative wound | 1 | 1.6% |
| Dialysis disequilibrium syndrome | 1 | 1.6% |

The above table shows that Hypotension (n=33, 51.60%) was the most common complication in present study followed by vomiting (n=18, 28.1%) and fever with rigors (n=17, 26.6%).

Table 3) Showing association of complications in vascular access with types of vascular access

| Vascular access | Complications in Vascular access | | Total (%) | Pearson Chi square value | p value |
|-----------------------|----------------------------------|------------|------------|--------------------------|----------------------------|
| | Yes (%) | No (%) | | | |
| Femoral vein | 14 (21.9%) | 31 (48.4%) | 45 (70.3%) | 0.280 | 0.869 (Not significant) |
| Internal jugular vein | 4 (6.3%) | 7 (10.9%) | 11 (17.2%) | | |
| Subclavian vein | 2 (3.1%) | 6 (9.4%) | 8 (12.5%) | | |
| Total | 20 (31.3%) | 44 (68.7%) | 64 (100%) | | |

The above table shows that, access without complications 44 (68.7%) were more than the access with complication 20 (31.3%).

No statistical difference was found between complication in vascular access with types of vascular access i.e.

complications of vascular access were not significantly associated with types of vascular access ($p = 0.869$).

Table 4) Showing association of complications in vascular access with types of vascular access

| Vascular access | Complications in Vascular access | | Total (%) | Pearson Chi square value | p value |
|-----------------------|----------------------------------|------------|------------|--------------------------|----------------------------|
| | Yes (%) | No (%) | | | |
| Femoral vein | 14 (21.9%) | 31 (48.4%) | 45 (70.3%) | 0.280 | 0.869 (Not significant) |
| Internal jugular vein | 4 (6.3%) | 7 (10.9%) | 11 (17.2%) | | |
| Subclavian vein | 2 (3.1%) | 6 (9.4%) | 8 (12.5%) | | |
| Total | 20 (31.3%) | 44 (68.7%) | 64 (100%) | | |

The above table shows that, access without complications 44 (68.7%) were more than the access with complication 20 (31.3%).

No statistical difference was found between complication in vascular access with types of vascular access i.e. complications of vascular access were not significantly associated with types of vascular access ($p = 0.869$).

Table 5) Showing complications of Vascular Access

| Complications in Access | Femoral vein (%) | Internal jugular vein (%) | Subclavian vein (%) | Total (%) |
|---|------------------|---------------------------|---------------------|------------|
| Catheter clotted | 6(9.4%) | 3(4.7%) | 1(1.6%) | 10 (15.6%) |
| Haematoma at cathetersite | 6(9.4%) | ... | ... | 6 (9.4%) |
| Malposition of catheter and Haemothorax | ... | ... | 1(1.6%) | 1 (1.6%) |
| Patient removed catheter | 2(3.1%) | 1(1.6%) | ... | 3 (4.7%) |
| No complications | 31(48.4%) | 7(10.9%) | 6(9.4%) | 44 (68.7%) |
| Total | 45(70.3%) | 11(17.2%) | 8(12.5%) | 64 (100%) |

The above table shows that catheter clotted was the most common complication seen in the present study ($n=10$,

15.6%) and was most common in femoral vein access (n=6, 9.4%). 31(48.4%) patients with femoral access did not have any complications.

Two complications of vascular access i.e. malposition of catheter and haemothorax were seen in the same patient.

Discussion:

Acute kidney injury (AKI) is a critical condition that often requires the support of ventilators to manage respiratory distress in severely affected patients. In our study, we found that ventilator support was required in 34.4% of the total 64 patients with AKI. This highlights the significance of respiratory complications and the need for close monitoring and intervention in patients with AKI.

When examining the complications associated with hemodialysis (HD) in our study, we identified several noteworthy findings. Hypotension was the most prevalent complication, occurring in 51.6% of patients. Hypotension during HD is a common occurrence due to fluid shifts, vascular access issues, and rapid changes in blood volume. It emphasizes the need for careful monitoring of blood pressure during HD sessions and the implementation of strategies to prevent and manage hypotensive episodes effectively.^{7,8}

Vomiting was the second most common complication observed in our study, affecting 28.1% of patients. Nausea and vomiting during HD can be attributed to various factors such as electrolyte imbalances, rapid changes in fluid balance, uremic toxins, and the dialysis procedure itself. Proper assessment and management of these symptoms are crucial to ensure patient comfort and minimize complications.⁹

Fever with rigors was another notable complication observed in 26.6% of patients. Infections, particularly bloodstream infections, can lead to fever with rigors during HD. Strict adherence to infection prevention protocols, including aseptic techniques during vascular access procedures and dialysis equipment handling, is vital to reduce the risk of infections and associated complications.¹⁰

Premature termination of HD sessions was observed in 9.4% of patients. This may be due to various reasons such as hypotension, inadequate vascular access, patient discomfort, or technical issues. Strategies to optimize vascular access, closely monitor patients during HD, and ensure patient comfort are essential to minimize premature terminations and enhance treatment efficacy.

In terms of vascular access complications, the femoral vein was the most common site of access in our study. However, no statistically significant association was found between the type of vascular access and the occurrence of complications. This suggests that while femoral access was more prevalent, it did not significantly increase the risk of complications compared to other access sites such as the internal jugular or subclavian veins.

Among the vascular access complications, catheter clotting was the most frequent, occurring in 15.6% of patients. This complication was predominantly observed in patients with femoral vein access. Adequate anticoagulation, regular monitoring, and maintenance of proper flow rates are essential to prevent catheter clotting. It is crucial to ensure the patency of the access site to optimize the effectiveness of hemodialysis.

The findings from our study emphasize the importance of diligent monitoring, early recognition, and appropriate management of complications associated with short-term hemodialysis in patients with acute kidney injury. Hypotension, vomiting, fever with rigors, and premature termination of HD sessions were among the notable complications identified. Furthermore, while the femoral vein was the most common access site, it did not significantly increase the risk of complications compared to other access sites.

To improve patient outcomes and minimize complications, healthcare professionals should focus on implementing preventive measures such as strict infection control practices, optimizing fluid management, and ensuring proper vascular access care. Additionally, close monitoring of patients during HD sessions and prompt intervention in case of complications are essential components of high-quality care.

It is important to acknowledge that our study had certain limitations, including its retrospective nature, a relatively small sample size, and single-center data. These limitations may impact the generalizability of the findings. Future studies with larger sample sizes and multi-center designs are needed to further explore and validate our results.

In conclusion, our study sheds light on the complications associated with short-term hemodialysis (HD) in patients with acute kidney injury (AKI). Hypotension emerged as the most prevalent complication, followed by vomiting and fever with rigors. These findings highlight the need for vigilant monitoring and effective management strategies during HD sessions to minimize these complications.

Ventilator support was required in a significant proportion of AKI patients, emphasizing the close relationship between kidney function and respiratory distress. This underscores the importance of interdisciplinary collaboration between nephrologists and critical care specialists in managing AKI patients.

Regarding vascular access complications, catheter clotting was the most common issue observed, predominantly in patients with femoral vein access. Attention to anticoagulation measures, flow rates, and regular monitoring is crucial to prevent catheter clotting and maintain optimal dialysis efficiency.

Interestingly, our study did not find a significant association between the type of vascular access and the occurrence of complications. However, it is important to note that the femoral vein was the most frequently used access site in our study. Larger-scale studies are needed to further investigate this relationship and assess the long-term outcomes associated with different access types.

Our findings emphasize the importance of comprehensive patient care in the management of AKI and HD. Strategies to prevent complications should include infection control measures, optimization of fluid balance, and proactive management of electrolyte imbalances. Additionally, close monitoring of blood pressure during HD sessions and prompt intervention in case of hypotensive episodes can greatly improve patient safety and treatment outcomes.

It is essential to acknowledge the limitations of our study, including its retrospective design, relatively small sample size, and single-center nature. Future research should aim for larger, multicenter studies to enhance the generalizability and robustness of the findings

Conclusion:

In conclusion, our study sheds light on the complications associated with short-term hemodialysis (HD) in patients with acute kidney injury (AKI). Hypotension emerged as the most prevalent complication, followed by vomiting and fever with rigors. These findings highlight the need for vigilant monitoring and effective management strategies during HD sessions to minimize these complications.

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