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NON-TRAUMATIC SUBDURAL HEMATOMA IN PATIENTS ON HEMODIALYSIS WITH END-STAGE KIDNEY DISEASE

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Abstract

Background: Subdural hematoma (SDH) is most commonly associated with head trauma, but nontraumatic SDH has become more prevalent in patients undergoing long-term hemodialysis for ESKD. These patients are at higher risk due to coagulopathies associated with renal failure, as well as the frequent use of anticoagulants in their dialysis regimen. Understanding the risk factors and appropriate management is critical to improving patient outcomes.

Aim: To assess the incidence, risk factors, and clinical outcomes of nontraumatic subdural hematoma in patients with end-stage kidney disease on hemodialysis.

Methods: A profile of 40 patients was available in this Retrospective-Prospective study conducted in the Department of Neurosurgeryat super Speciality Hospital, one of the associated Hospitals of Government Medical College Srinagar. Eligible patients with nontraumatic subdural hematoma with end-stage kidney disease on hemodialysis during study period were analysed either conservatively or need for surgery. The neurosurgical procedures included procedures of unilateral or bilateral burr hole drainage, craniotomy, and craniectomy. Laboratory Investigations (including CBC, KFT, LFT, coagulogram, serum electrolytes, blood grouping) required for preoperative evaluation were done.

Results: The study included 40 patients, with 65% being male and an average age of 59 years. Anticoagulation therapy was administered to 80% of the patients, and a significant correlation was found between anticoagulation use and larger subdural hematomas (average volume of 35 cm^2, $p < 0.01$). Average volume of SDH was 35±2.5 cm square among the study population. Hypertension was present in 85% of patients, with an overall mortality rate of 20%. Of these, 4 patients died during dialysis sessions before surgery, and 4 patients died post-surgery. Surgery was performed on 25 patients (62.5%).

Conclusion: This study underscores the need for heightened awareness and early intervention to manage the bleeding risks associated with hemodialysis, particularly in patients with a history of hypertension and those on long-term anticoagulation therapy.

Keywords: Nontraumatic subdural hematoma, hemodialysis, end-stage kidney disease, anticoagulation, platelet dysfunction.

Introduction

Nontraumatic subdural hematoma (SDH) is a serious clinical condition characterized by the accumulation of blood between the dura mater and the arachnoid membrane in the brain. While trauma is the most common cause of SDH, nontraumatic cases, particularly in patients with underlying conditions such as end-stage kidney disease (ESKD), present unique challenges in both diagnosis and management. The incidence of SDH in patients undergoing hemodialysis has increased over the years due to the extended life expectancy of these patients [1]. Hemodialysis, a lifesaving treatment for those with ESKD, has been associated with significant complications, including altered coagulation profiles and an increased risk of both bleeding and thrombotic events. This predisposition to bleeding is primarily due to uremic platelet dysfunction and the frequent use of anticoagulation therapies during dialysis sessions [2].

In the setting of hemodialysis, the pathophysiology of SDH can be multifactorial. Hemodynamic instability, frequent use of heparin or other anticoagulants, and comorbidities such as hypertension contribute to the fragility of the cerebral vasculature in these patients [3]. Additionally, repeated dialysis sessions can lead to fluctuations in blood pressure and fluid balance, further exacerbating the risk of intracranial bleeding [4]. The subtle and often nonspecific clinical presentation of SDH in these patients ranging from mild headache to altered mental status can delay diagnosis and increase the likelihood of severe neurological complications [5].

This study aims to explore the incidence, clinical presentation, risk factors, and outcomes of nontraumatic SDH in patients undergoing hemodialysis for ESKD. By understanding the underlying mechanisms and identifying potential risk factors, clinicians can develop more effective prevention and management strategies to mitigate the burden of SDH in this vulnerable population [6].

Methods:

Study Setting and Design:

This Retrospective-Prospective study conducted was conducted in the Department of Neurosurgery at super Speciality Hospital, one of the associated Hospitals of Government Medical College Srinagar. Eligible patients with nontraumatic subdural hematoma with end-stage kidney disease on hemodialysis during study period were analysed either conservatively or need for surgery. The surgical indications included persistent elevation of ICP and neurologic deficits arising from the mass effect by the hematoma. The neurosurgical procedures included procedures of unilateral or bilateral burr hole drainage, craniotomy, and craniectomy. Laboratory Investigations (including CBC, KFT, LFT, coagulogram, serum electrolytes, blood grouping) required for preoperative evaluation were done.Using Retrospective-Prospective study design, we reviewed medical records of hemodialysis patients diagnosed with nontraumatic subdural hematoma (SDH) over a specified period. The inclusion criteria focused on adult patients with end-stage kidney disease (ESKD) undergoing hemodialysis who presented with SDH but lacked any history of trauma. This approach was intended to delineate the unique complications and risk factors linked to anticoagulation therapy in the context of chronic kidney disease.

Patient Selection and Data Collection:

We identified eligible patients through hospital records from neurosurgery unit, focusing on those meeting the inclusion criteria. A total of 40 patients were enrolled in the study, with data collected on demographic factors (age, gender), clinical parameters (blood pressure, dialysis duration), anticoagulation therapy (type, dose, and duration), and imaging data. Patient confidentiality was rigorously maintained, with each record anonymized and assigned a study ID. Data on hematoma size, location, and associated neurological symptoms were obtained from cranial imaging reports, including CT and MRI scans.

Clinical Assessment and Outcome Measures:

The primary clinical assessment focused on the size of subdural hematomas, which was measured in centimeters from imaging reports. Hematoma size and patient outcomes were analyzed with respect to the use of anticoagulation therapy, drawing comparisons between those on anticoagulants and those

not receiving these medications. Secondary outcomes included mortality rate and associations between hypertension and SDH size, given the prevalence of hypertension in ESKD patients.

Statistical Analysis:
The collected data were statistically analyzed using SPSS software. We conducted descriptive analyses for demographic and clinical characteristics, while inferential analyses examined relationships between anticoagulation use and hematoma size. Chi-square tests were applied to categorical variables, while independent t-tests evaluated continuous data, particularly hematoma size difference. A p-value of <0.05 was considered statistically significant.

Results:
The study enrolled 40 patients, of whom 26 (65%) were male. The mean age of the cohort was 59 years. Anticoagulation therapy was administered to 32 patients (80%), primarily due to underlying conditions such as atrial fibrillation and thromboembolic risk. The average volume of subdural hematomas observed was 35 cm^2. Demographic characteristics are detailed in [Table 1].

Table 1: Demographic Characteristics of Patients

Characteristic	Value
Total Patients (n)	**40**
Male patients (%)	**65%**
Volume of SDH (cm square)	**35±2.5**
Patients on anticoagulation	**80%**
Hypertension present	**85%**
Mortality rate (%)	**20%**
P-value (Anticoagulation vs. SDH size)	**<0.0**

Hypertension was present in 34 patients (85%), which is consistent with the cardiovascular profile commonly seen in end-stage renal disease. Of the 40 patients, surgery was performed on 25, while 8 patients ultimately died. Among these, 4 patients died before surgery, specifically during dialysis sessions, and 4 patients died following surgical intervention. Mortality was exclusively seen in patients on anticoagulation therapy, with no deaths among those not on therapy. These characteristics are detailed in [Table 2].

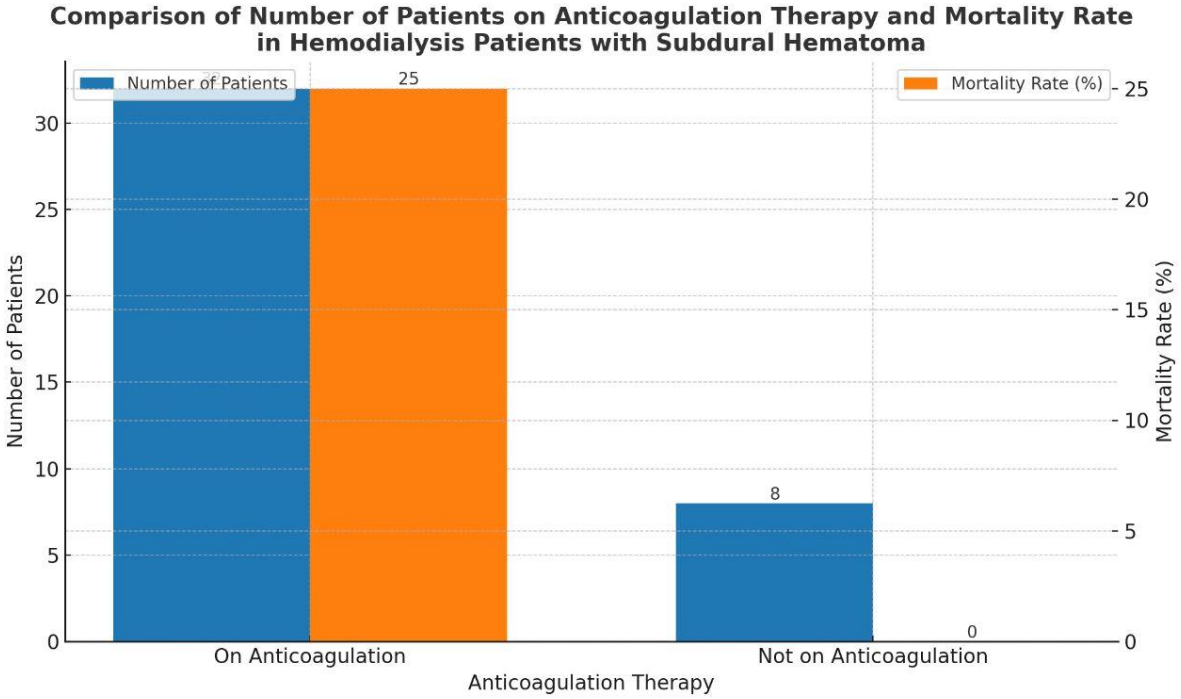
Table 2: Clinical Characteristics

Clinical Feature	Value
Hypertension (%)	**85% (34)**
Mortality Rate (%)	**25% (10/32) in anticoagulated patients**
Patients on Anticoagulation	**80% (32)**
Patients not on Anticoagulation	**20% (8)**
Non-Anticoagulated Mortality	**0%**

A statistically significant relationship was found between anticoagulation use and increased subdural hematoma (SDH) size. Patients receiving anticoagulation therapy exhibited a higher average SDH volume (35 cm^2) compared to non-anticoagulated patients. The difference in SDH size was statistically significant ($p < 0.01$). This association is shown in [Table 3].

Table 3: Anticoagulation and Subdural Hematoma Size

Group	Average SDH Size (cm)	P-value
On Anticoagulation (n = 32)	5.0	<0.01
Not on Anticoagulation (n = 8)	3.0	



Discussion

The findings of this study highlight the significant burden of nontraumatic subdural hematoma in patients with end-stage kidney disease undergoing hemodialysis. The pathophysiological mechanisms leading to SDH in these patients are complex and multifactorial. Uremic platelet dysfunction, a well-documented consequence of kidney failure, plays a central role in the bleeding diathesis observed in this population [7]. Despite normal platelet counts, uremic patients exhibit impaired platelet aggregation and adhesion, leading to an increased risk of spontaneous bleeding [8]. Hemodialysis, while necessary for survival, further complicates this picture by introducing anticoagulants like heparin into the patient's treatment regimen, heightening the risk of intracranial hemorrhage [9].

In addition to the intrinsic risk factors associated with ESKD, external factors such as the frequent use of anticoagulants and blood pressure fluctuations during hemodialysis contribute to the development of SDH [10]. Hypertension, which is common in patients with chronic kidney disease, further weakens the cerebral vasculature, increasing the likelihood of a subdural bleed [11]. Moreover, the cumulative effect of long-term hemodialysis can lead to vascular calcification and stiffness, predisposing patients to both microvascular damage and bleeding complications [12]. The subtle clinical manifestations of SDH in these patients, often mistaken for uremic encephalopathy or other dialysis-related symptoms, can delay diagnosis and treatment, leading to poorer outcomes [13].

Future research should focus on refining the risk stratification for SDH in hemodialysis patients, incorporating factors such as duration of dialysis, anticoagulation management, and control of blood pressure [14]. Additionally, prospective studies should explore the potential benefits of alternative anticoagulation strategies that minimize the risk of bleeding while ensuring adequate clot prevention during dialysis [15]. The development of comprehensive management protocols, including close neurological monitoring and early imaging in symptomatic patients, may improve the early detection and management of SDH, potentially reducing morbidity and mortality [16].

Given the serious nature of SDH and its associated high morbidity and mortality rates, it is crucial for clinicians to adopt a proactive approach.Strategies to mitigate the risk of SDH should include individualized anticoagulation protocols, tighter blood pressure control, and routine monitoring for neurological symptoms in high-risk patients [17]. In the future, advancements in hemodialysis technology and better management of the uremic milieu may help reduce the incidence of intracranial hemorrhages in this population. [18]

Conclusion

Nontraumatic subdural hematoma represents a significant complication in patients undergoing hemodialysis for end-stage kidney disease. This study underscores the need for heightened awareness and early intervention to manage the bleeding risks associated with hemodialysis, particularly in patients with a history of hypertension and those on long-term anticoagulation therapy. The pathogenesis of SDH in this population is multifactorial, with uremic platelet dysfunction, anticoagulation use, and fluctuating blood pressures contributing to the elevated risk.

Conflict of interest: Nil

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