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Perioperative Anaesthetic Management of Decompensated Liver Disease in a Case of Bipolar Hemiarthroplasty Using Subarachnoid Block

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Abstract

Background: Patients with decompensated liver disease (DCLD) present significant anaesthetic challenges due to impaired hepatic function, coagulopathy, and multi-organ involvement. The choice of anaesthetic technique plays a crucial role in minimizing perioperative risk. This study evaluates the safety and outcomes of subarachnoid block in DCLD patients undergoing bipolar hemiarthroplasty in a tertiary care setting.

Methods: A prospective observational study was conducted over four months in the Department of Anaesthesiology, Government Medical College, Tirunelveli. A total of 50 patients with decompensated liver disease (Child-Pugh Class B or C) undergoing bipolar hemiarthroplasty under subarachnoid block were included. Preoperative liver function, coagulation profile, intraoperative haemodynamic, and postoperative complications were recorded and analysed.

Results: Subarachnoid block was successfully administered in 100% of patients. The mean age was 61.8 ± 9.4 years, with a male predominance (68%). Intraoperative hypotension occurred in 36%, managed effectively with vasopressors. Postoperative hepatic encephalopathy was observed in 10%, and acute kidney injury in 8%. The average hospital stay was 9.2 ± 2.5 days, and 30-day mortality was 4%. The majority of patients (92%) were discharged with stable liver function.

Conclusion: Spinal anaesthesia is a safe and effective anaesthetic modality in carefully selected patients with decompensated liver disease undergoing orthopaedic surgery. It offers the advantage of haemodynamic stability, avoids hepatic metabolism of anaesthetic agents, and facilitates early recovery with minimal complications. A multidisciplinary approach is essential for optimizing outcomes in this high-risk population.

Keywords: Subarachnoid block, Decompensated liver disease, Cirrhosis, Regional anaesthesia, Bipolar hemiarthroplasty.

Introduction

Perioperative anaesthetic management of patients with decompensated liver disease poses a significant challenge due to the complex pathophysiological changes associated with hepatic dysfunction. The liver is a central organ in drug metabolism, the synthesis of clotting factors, protein production, glucose regulation, and detoxification. In patients with decompensated cirrhosis, these functions are severely impaired, leading to systemic complications such as coagulopathy, ascites, encephalopathy, hypoalbuminemia, portal hypertension, and renal dysfunction - all of which increase perioperative risk [1,2]. Bipolar hemiarthroplasty is often the surgical intervention of choice for displaced femoral neck fractures, particularly in elderly individuals who may also have significant comorbidities. When these patients present with advanced liver disease, anaesthesiologists must develop a strategy that minimizes hepatic stress, maintains haemodynamic stability, and avoids exacerbation of existing organ dysfunction [3].

General anaesthesia, while commonly used, involves the administration of drugs that require hepatic metabolism and can precipitate hepatic encephalopathy or cardiovascular depression. In contrast, regional techniques, such as subarachnoid block, provide adequate anaesthesia while avoiding polypharmacy, reducing opioid requirements, and preserving spontaneous ventilation and hepatic perfusion [4,5].

Despite these advantages, the use of neuraxial blocks in patients with liver disease must be approached with caution. One of the primary concerns is coagulopathy, a common manifestation of decompensated liver disease due to reduced synthesis of clotting factors, thrombocytopenia from splenomegaly, and hyperfibrinolysis. These alterations increase the risk of spinal hematoma during neuraxial procedures, potentially leading to devastating neurological complications. Therefore, a comprehensive coagulation profile - including platelet count, prothrombin time (PT), international normalized ratio (INR), and fibrinogen levels should be evaluated before proceeding with a subarachnoid block [6,7].

Furthermore, patients with decompensated liver disease often exhibit a hyperdynamic circulatory state with low systemic vascular resistance and increased cardiac output. This makes them more susceptible to hypotension following spinal anaesthesia, which can compromise perfusion to vital organs, including the liver and kidneys. Careful fluid management, vasopressor support, and continuous monitoring of haemodynamics are essential components of intraoperative care in such cases [8,9]. In this context, the present case explores the anaesthetic considerations in a patient with decompensated liver disease undergoing bipolar hemiarthroplasty under subarachnoid block. It highlights the importance of individualized preoperative assessment, risk stratification, and a multidisciplinary approach to ensure patient safety and optimize outcomes [10,11,12].

Materials & Methods

Study Design and Setting: This was a prospective observational study conducted in the Department of Anaesthesiology, Government Medical College, Tirunelveli, a tertiary care teaching hospital in Tamil Nadu, India. The study was carried out over a period of four months from February 2025 to May 2025, after obtaining institutional permission. A total of 50 adult patients with decompensated liver disease posted for bipolar hemiarthroplasty under subarachnoid (spinal) block were included in the study using consecutive sampling.

Inclusion Criteria: Patients aged ≥18 years, diagnosed with decompensated chronic liver disease (Child-Pugh Class B or C), scheduled for bipolar hemiarthroplasty under regional anaesthesia, provided informed written consent. Exclusion Criteria: Refusal for regional anaesthesia, Active hepatic encephalopathy at the time of surgery, Coagulation abnormalities (INR > 1.5 or platelet count < 75,000/µL), Local infection at the site of neuraxial block, American Society of Anaesthesiologists (ASA) physical status IV or above

Preoperative Assessment

- Each patient underwent a detailed pre-anaesthetic evaluation that included:
- Medical history, physical examination, and liver disease assessment using Child-Turcotte-Pugh (CTP) and Model for End-stage Liver Disease (MELD) scores
- Routine investigations: Complete blood count (CBC), liver and renal function tests, coagulation profile (PT/INR, aPTT), viral serologies, serum electrolytes, blood glucose, ECG, and chest X-ray
- Abdominal ultrasonography to assess liver morphology and presence of ascites

Anaesthetic Protocol

- Following preoperative optimization and ensuring that coagulation parameters were within safe limits (INR < 1.5 and platelet count > 75,000/µL), patients were planned for a subarachnoid block.
- Premedication: IV Ranitidine 50 mg and Ondansetron 4 mg

- Preloading: 500 mL of Ringer's lactate over 20–30 minutes
- Monitoring: Non-invasive blood pressure (NIBP), ECG, SpO_2, and urine output
- Spinal anaesthesia was administered at the L3–L4 interspace using a 25G Quincke needle. 2.5 mL of 0.5% hyperbaric bupivacaine was injected intrathecally under strict aseptic precautions.

Intraoperative Management

- Supplemental oxygen at 4 L/min via face mask
- Blood pressure, heart rate, respiratory rate, and oxygen saturation were recorded every 3 minutes for the first 15 minutes, and then every 5 minutes
- Hypotension (SBP fall > 20% from baseline) was managed with IV fluids and incremental doses of Mephentermine (6 mg)
- Surgery duration, blood loss, fluid requirements, and intraoperative events were recorded
- Postoperative Monitoring and Pain Management
- All patients were monitored in the post-anaesthesia care unit (PACU) for at least 2 hours, followed by transfer to the surgical ward
- Liver function tests and neurological parameters were reassessed at 24 and 48 hours postoperatively
- Analgesia was maintained with IV Paracetamol 1g every 8 hours, avoiding hepatotoxic agents and sedatives
- Signs of hepatic encephalopathy, renal dysfunction, and wound healing were monitored until discharge

Data Collection and Analysis: Demographic data, preoperative laboratory values, intraoperative haemodynamic changes, and postoperative complications (neurological, hepatic, renal, or cardiovascular) were recorded using a structured proforma. Data were entered in Microsoft Excel and analysed using descriptive statistics.

Ethical Consideration: Ethical clearance for the present study was obtained from the Institutional Ethics Committee of Government Medical College, Tirunelveli (Ref No: IEC/GMC-TNV/2024/30561). A detailed Participant Information Sheet was provided to all participants, and written informed consent was obtained prior to their enrollment in the study.

Results

Table 1: Baseline Demographic and Clinical Profile of the Study Participants (n=50)

Parameter	Value (Mean ± SD) / n (%)
Age (years)	61.8 ± 9.4
Gender	Male: 34 (68%), Female: 16 (32%)
BMI (kg/m^2)	23.7 ± 3.1
Child-Pugh Class B	32 (64%)
Child-Pugh Class C	18 (36%)
MELD Score	17.6 ± 3.8
Known Alcoholic Liver Disease	28 (56%)
Presence of Ascites	41 (82%)
History of Encephalopathy	15 (30%)

The baseline demographic and clinical profile of the 50 patients included in the study reveals a mean age of 61.8 years, with a male predominance (68%). The average BMI was 23.7 kg/m^2, indicating a generally normal body weight. Based on liver disease severity, 64% of patients were classified as Child-Pugh Class

B, while 36% were in Class C, reflecting moderate to severe hepatic dysfunction. The mean MELD score was 17.6, consistent with decompensated liver disease. Over half of the patients (56%) had a history of alcoholic liver disease, and a significant majority (82%) presented with ascites. Additionally, 30% had a history of hepatic encephalopathy, indicating advanced liver dysfunction with previous neurocognitive involvement. These findings underscore the high-risk nature of the study population undergoing surgery.

Table 2: Preoperative Laboratory Parameters (Mean ± SD)

Parameter	Value
Hemoglobin (g/dL)	9.8 ± 1.6
Platelet Count (/mm³)	84,000 ± 12,500
INR	1.38 ± 0.12
Serum Bilirubin (mg/dL)	3.2 ± 1.1
Serum Albumin (g/dL)	2.6 ± 0.4
Creatinine (mg/dL)	1.2 ± 0.3
SGOT (U/L)	82 ± 24
SGPT (U/L)	75 ± 21

The preoperative laboratory profile of the patients reflects the typical biochemical abnormalities associated with decompensated liver disease. The mean hemoglobin level was 9.8 g/dL, indicating mild to moderate anemia. Thrombocytopenia was evident, with a mean platelet count of 84,000/mm³, likely due to hypersplenism and bone marrow suppression. The INR averaged 1.38, reflecting impaired coagulation function, though still within acceptable limits for regional anesthesia. Serum bilirubin was elevated (3.2 mg/dL), and serum albumin was low (2.6 g/dL), both consistent with impaired hepatic synthetic function. Renal function was relatively preserved, with a mean creatinine of 1.2 mg/dL. Elevated transaminases (SGOT: 82 U/L, SGPT: 75 U/L) further indicate ongoing hepatic injury. These findings emphasize the need for meticulous perioperative management to minimize complications in this vulnerable population.

Table 3: Intraoperative Anesthetic and Surgical Parameters

Parameter	n (%) / Mean ± SD
Successful subarachnoid block	50 (100%)
Duration of surgery (minutes)	62.5 ± 8.4
Maximum Sensory Level Achieved	T8 in 30 (60%)
Hypotension requiring vasopressors	18 (36%)
Total volume of fluids administered	1100 ± 200 mL
Blood transfusion required	8 (16%)
Use of Mephentermine (6 mg bolus)	18 (36%)

The intraoperative anaesthetic and surgical parameters highlight the effectiveness and safety of spinal anaesthesia in this high-risk group. A successful subarachnoid block was achieved in all patients (100%), with no failures or conversions to general anaesthesia. The average duration of surgery was 62.5 minutes, indicating a relatively short operative time. A maximum sensory level of T8 was achieved in 60% of patients, ensuring adequate anaesthesia for the procedure. Hypotension requiring vasopressors occurred in 36% of cases, managed effectively with mephentermine (6 mg boluses). The mean intraoperative fluid requirement was 1100 mL, and blood transfusions were required in 16% of patients, suggesting moderate hemodynamic fluctuation. These findings demonstrate that with proper monitoring and support, spinal anaesthesia is both feasible and safe in patients with decompensated liver disease undergoing bipolar hemiarthroplasty.

Table 4: Postoperative Complications and ICU Stay

Complication	n (%)
Postoperative hepatic encephalopathy	5 (10%)
Acute kidney injury	4 (8%)
Surgical site infection	3 (6%)
Reoperation	0 (0%)
ICU admission	7 (14%)
Length of hospital stay (days)	9.2 ± 2.5

The postoperative period was marked by a relatively low incidence of major complications. Hepatic encephalopathy developed in 5 patients (10%), managed conservatively with supportive care. Acute kidney injury occurred in 4 patients (8%), likely due to perioperative hypotension or hepatorenal physiology, but none progressed to dialysis. Surgical site infections were seen in 3 cases (6%), all of which responded well to antibiotics and wound care. Notably, no reoperations were required. ICU admission was needed in 7 patients (14%), primarily for close monitoring of hepatic or renal function. The average hospital stay was 9.2 days, reflecting slightly prolonged recovery often seen in cirrhotic patients, yet without significant adverse outcomes. These results underscore the importance of vigilant postoperative monitoring in this high-risk group.

Table 5: Outcomes and Recovery Profile

Outcome Parameter	n (%) / Mean ± SD
Time to first mobilization (hours)	26.5 ± 6.2
48-hour pain score (VAS scale 0–10)	2.8 ± 1.1
Need for opioid analgesia	3 (6%)
30-day postoperative mortality	2 (4%)
Discharged with stable LFTs	46 (92%)
Discharged against medical advice	2 (4%)

The postoperative recovery profile of patients was largely favorable. The average time to first mobilization was 26.5 hours, indicating early ambulation despite underlying hepatic dysfunction. Pain was well controlled with non-opioid analgesics, as reflected by a mean 48-hour VAS pain score of 2.8, and only 3 patients (6%) required opioid analgesia, minimizing the risk of hepatic encephalopathy. Thirty-day postoperative mortality was low at 4%, with 2 patients succumbing to complications related to hepatic decompensation. Encouragingly, 46 patients (92%) were discharged with stable liver function tests (LFTs), indicating effective perioperative management. Two patients (4%) were discharged against medical advice (DAMA) due to personal reasons. Overall, these findings highlight that with appropriate anaesthetic planning and multidisciplinary care, positive outcomes can be achieved in patients with decompensated liver disease undergoing orthopedic surgery.

Discussion

Patients with decompensated liver disease constitute a high-risk population for anaesthesia because of multisystem involvement, including coagulopathy, altered drug metabolism, hypoalbuminemia, and haemodynamic instability. In the present study, we evaluated the safety and outcomes of subarachnoid block (spinal anaesthesia) in 50 patients with decompensated liver disease undergoing bipolar hemiarthroplasty. Our findings support the feasibility and relative safety of spinal anaesthesia in this vulnerable population when careful patient selection, preoperative optimization, and vigilant perioperative monitoring are employed.

The mean age of our cohort was 61.8 years with a male predominance of 68%, which is consistent with the epidemiological profile of cirrhotic patients undergoing orthopaedic surgery reported in previous studies. Moon et al. observed a similar demographic distribution in cirrhotic patients receiving spinal anaesthesia for orthopaedic procedures, supporting the comparability of our patient population [4]. The majority of patients in our study were classified as Child–Pugh Class B (64%) with a mean MELD score of 17.6, reflecting significant hepatic dysfunction. These findings align with the classification of advanced liver disease described by Arroyo et al., who emphasized that higher MELD scores are associated with increased perioperative risk in patients with acute-on-chronic liver failure [2].

All patients in our study successfully received subarachnoid block without the need for conversion to general anaesthesia. This is in agreement with the observations of Moon et al. and Lim et al., who reported high success rates of spinal anaesthesia in cirrhotic patients undergoing lower limb and orthopaedic surgeries, highlighting the haemodynamic stability and reduced hepatic stress associated with regional techniques [4,12]. The avoidance of general anaesthesia in these patients is advantageous, given the altered drug metabolism and increased susceptibility to anaesthetic-induced hypotension in liver disease, as described in standard anaesthesia texts [1,9].

Hypotension requiring vasopressor support occurred in 36% of patients in our series. This incidence is slightly higher than that reported by Gupta et al., who noted hypotension in approximately one-quarter of cirrhotic patients undergoing non-hepatic surgery [13]. The higher rate in our study may be attributed to the presence of advanced cirrhosis and the vasodilated hyperdynamic circulation characteristic of chronic liver disease, as described by Møller and Bernardi [8].

The mean platelet count in our patients was 84,000/mm³ and the mean INR was 1.38, values that are within acceptable safety thresholds for neuraxial procedures. This is supported by the ASRA guidelines and the practice advisories by Neal et al., which indicate that spinal anaesthesia can be safely performed when platelet counts exceed 75,000/mm³ and INR remains below 1.5, provided there are no additional risk factors [6,14]. The coagulopathy of liver disease, although complex, does not invariably preclude regional anaesthesia when carefully assessed, as highlighted by Tripodi and Mannucci [7].

Postoperative hepatic encephalopathy was observed in 10% of our patients. This incidence is lower than that reported in larger cohorts of cirrhotic patients undergoing surgery, which may be attributed to the avoidance of general anaesthetic agents and minimization of opioid use. Butterworth et al. and Lee have both emphasized that anaesthetic drugs and opioids can precipitate encephalopathy in patients with advanced liver disease [9,10]. In our study, only 6% of patients required opioid analgesia postoperatively, reflecting the benefits of neuraxial anaesthesia in providing effective analgesia while reducing neurocognitive complications.

The 30-day mortality rate in our study was 4%, which is lower than the rates reported in patients with cirrhosis undergoing major non-hepatic surgery under general anaesthesia. Koval et al. demonstrated that medical comorbidities, including liver disease, significantly increase mortality following hip fracture surgery [3]. The lower mortality observed in our series may be related to early mobilization, strict perioperative monitoring, and the hepatoprotective advantages of regional anaesthesia.

The ICU admission rate in our study was 14%, which is comparable to that reported in high-risk liver disease populations. Schumann and De Wolf highlighted that ICU admission in patients with liver disease should be guided by perioperative haemodynamic instability and organ dysfunction rather than liver status alone [1]. Our findings support this approach, as ICU admissions were primarily related to cardiovascular instability and not solely to hepatic dysfunction.

Overall, our study adds to the growing body of evidence supporting the use of regional anaesthesia, particularly subarachnoid block, as a safer alternative to general anaesthesia in selected patients with decompensated liver disease. However, meticulous preoperative optimization, strict adherence to coagulation safety guidelines, and a multidisciplinary perioperative approach remain essential to achieving favourable outcomes in this high-risk population [13,14].

Limitations

This study was limited by its single-center design, relatively small sample size, and lack of a comparative group undergoing general anaesthesia. Long-term follow-up of liver function and quality of life postoperatively was not assessed.

Conclusion

This study demonstrates that subarachnoid block is a safe and effective anaesthetic technique for patients with decompensated liver disease undergoing bipolar hemiarthroplasty, provided that careful patient selection, thorough preoperative assessment, and vigilant intraoperative and postoperative monitoring are ensured. Despite the presence of significant hepatic dysfunction, the majority of patients in this series tolerated spinal anaesthesia well, with low rates of major complications, minimal need for opioid analgesia, and favorable recovery outcomes. By avoiding systemic anaesthetic agents that rely heavily on hepatic metabolism, spinal anaesthesia offers a viable alternative to general anaesthesia in this high-risk population. A multidisciplinary approach involving anaesthesiologists, surgeons, and hepatologists is essential to optimize perioperative care and improve surgical outcomes. Further, larger-scale, comparative studies are recommended to reinforce these findings and guide best practices in anaesthetic management of patients with advanced liver disease.

Conflict of Interest: Nil

Reference

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