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Case Series: Hepatic Portal Venous Gas Post Liver Transplant

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1. Abstract

The detection of hepatic portal venous (PV) gas can be a concerning finding often having grave prognosis of bowel ischaemia and gangrene. But the finding of PV gas in a patient who is clinically well may often be a benign finding with no ominous outcomes. PV gas can be a benign finding in the first two weeks after liver transplant. We present 5 cases of hepatic portal venous gas which were detected on routine post-transplant liver doppler study after Living Donor Liver Transplant (LDLT) within the first two weeks of undergoing liver transplant in clinically stable allograft recipients. Complete resolution of the PV gas was seen within 24 to 72 hours with no adverse effect on the patient recovery and outcome. Hence it can be concluded that portal venous gas can be a normal finding on doppler sonography in post liver transplant patients with self-limiting course and spontaneous resolution.

2. Introduction

Hepatic portal venous gas has a wide spectrum of causes and is detected through imaging with either sonography with or without doppler study or on CT scan of the abdomen. While hepatic PV gas detected in the earlier studies on plain abdominal radiograph was often associated with bowel ischaemia carrying a grave prognosis, modern abdominal CT has resulted in the detection of PV gas in more benign conditions [1-3]. The sign is being increasingly recognized in non-threatening iatrogenic and non-iatrogenic conditions [4]. One such condition is following liver transplantation, where the finding of PV gas/ mobile reflective echoes in the early postoperative period is a self-limiting finding and resolves in a few days. We present 5 cases of hepatic PV gas which were detected on routine post-transplant liver doppler study at our institute, a leading tertiary hospital and liver transplant center in India.

3. Methods and Observations

Between May 2020 and May 2022, a total of 173 patients underwent liver transplant at our institute, out of which 170 were living donor liver transplants and 3 were deceased donor liver transplants. Routine bedside doppler of the liver allograft is performed in all the liver allograft recipients in our institute as a protocol for the first seven days post-transplant. All the doppler studies were done by one of the two radiologists working with the liver transplant team, one with 9 years' and the other with 5 years' experience in abdominal imaging, on Phillips Affinity 50 Ultrasound system with convex transducer C2-5 MHz. Amongst the 173 liver allograft recipients, 5 patients were detected with small floating mobile echoes within the intra hepatic PV and its branches, moving in hepatopetal direction within the PV and its branches along the direction of flow, with the floating echoes extending into the liver parenchyma (Figure 1,2). An attempted doppler tracing of the PV and hepatic artery showed irregular high amplitude spikes superimposed over the tracing of the flow (Figure 1-b). All the 5 patients were reviewed by the other radiologist in the team with doppler sonography and on consensus, the findings were concluded as representing PV gas. These findings were noted between Post-Operative Day (POD)- 2 and POD -7, showing complete resolution between 24 to 72 hours

on the follow up doppler studies. All the patients were stable with no clinical presentation of either sepsis or bowel ischaemia and with stable or decreasing transaminase and bilirubin levels. None of the patients had any signs of graft failure. Hepatic arterial flow was well demonstrated in 4 out of the 5 patients on the doppler sonography.

Two out of the 5 patients (LAR-2 and LAR-3) who had persistent PV gas beyond 24 hours underwent plain CT scan of the upper abdomen. One of them (LAR-2, 62/M) demonstrated intra mural gas foci in the gastric walls, extending into the peri gastric veins, PV and within the hepatic parenchyma (Figure 3). A CT abdominal angiography was additionally performed in this patient to confirm arterial patency as the artifacts from the superimposed spikes in the doppler spectrum prevented the demonstration of arterial trace.

Since the patient was recovering well and demonstrated no signs of sepsis or graft failure, he was followed up with another plain CT scan of the abdomen after 3 days, which showed significant resolution of the intra mural and intra vascular gas. A diagnosis of gastric emphysema was made and the patient was subsequently discharged in a stable condition. The other patient (LAR-3,44/M) who underwent CT scan of the abdomen showed no evidence of gas either within the PV or in the liver parenchyma on CT. A follow up doppler study the next day showed complete resolution of the PV gas echoes which were noted the previous day on doppler. The other 3 out of the 5 patients showed complete resolution of the gas echoes on the follow up doppler study done after 24 hours (Table-1).

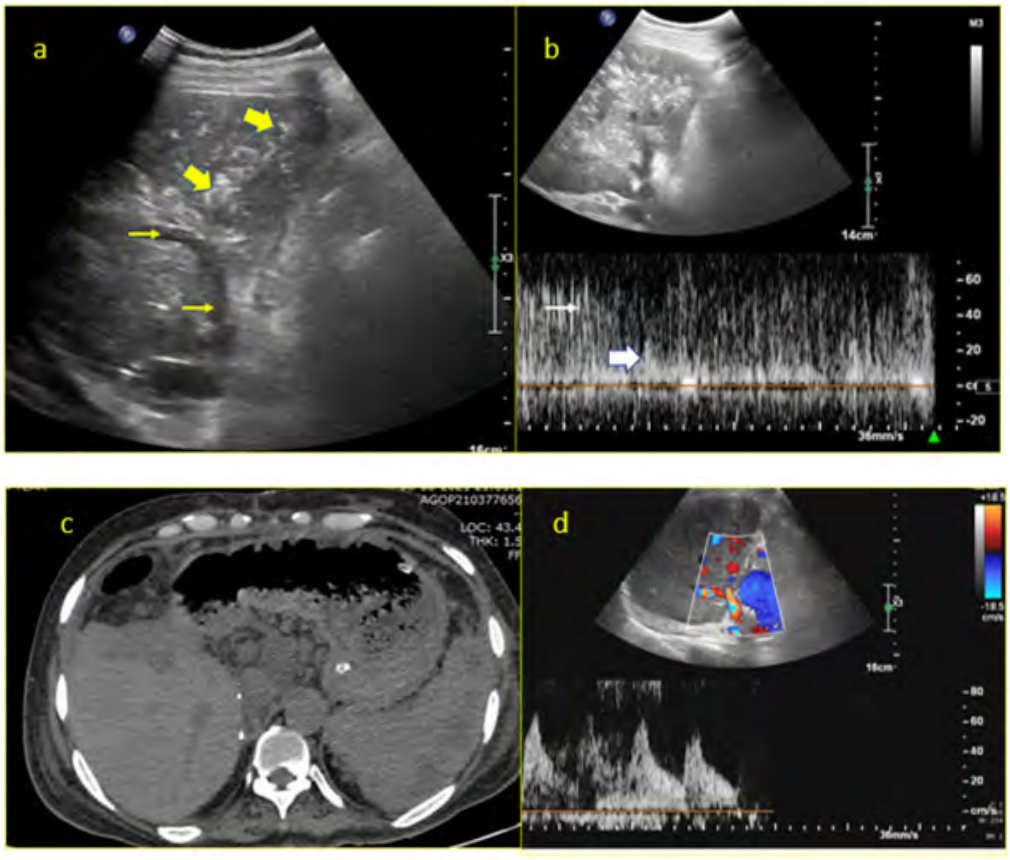

Figure 1: 44/M (LAR-3) Post LDLT. Sonography on POD-4 (a) demonstrates low level echoes within the portal vein (yellow arrow) and multiple air echoes in the liver parenchyma (yellow block arrows). The echoes in the portal vein and its divisions were mobile towards the direction of blood flow. An attempted spectral tracing of the hepatic artery (b) shows multiple irregular spikes (white arrow) superimposed over the baseline arterial trace (white block arrow). Plain CT scan of the upper abdomen (c) on POD-5 demonstrates no air in the liver parenchyma or in the portal vein branches. Follow up doppler sonography on POD -6 (d) shows resolution of the previously noted air echoes and significant reduction in the superimposed spikes over the arterial trace.

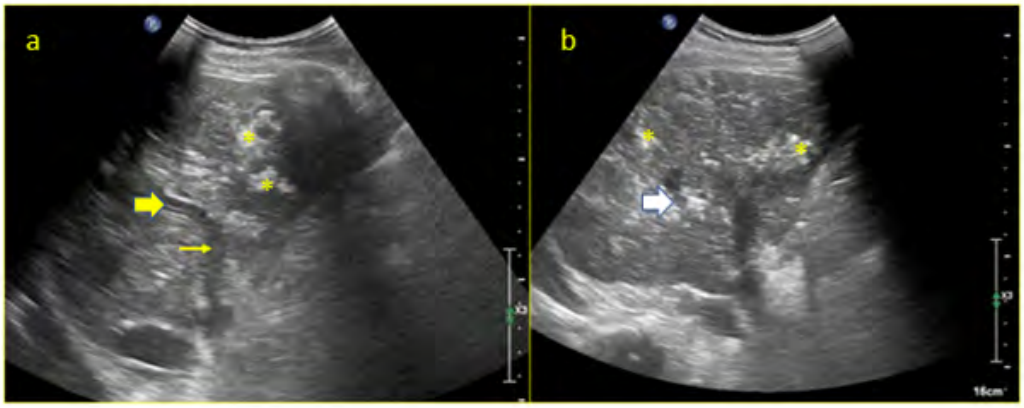

Figure 2: 50/M (LAR-5) post LDLT . Doppler sonography on POD-5 (a, b) demonstrates gas echoes within the portal vein (yellow arrow), its right division (yellow block arrow), in segment VII branch(white block arrow) and in the liver parenchyma(Asterix) . Follow up scan on the next day showed complete resolution of the echoes.

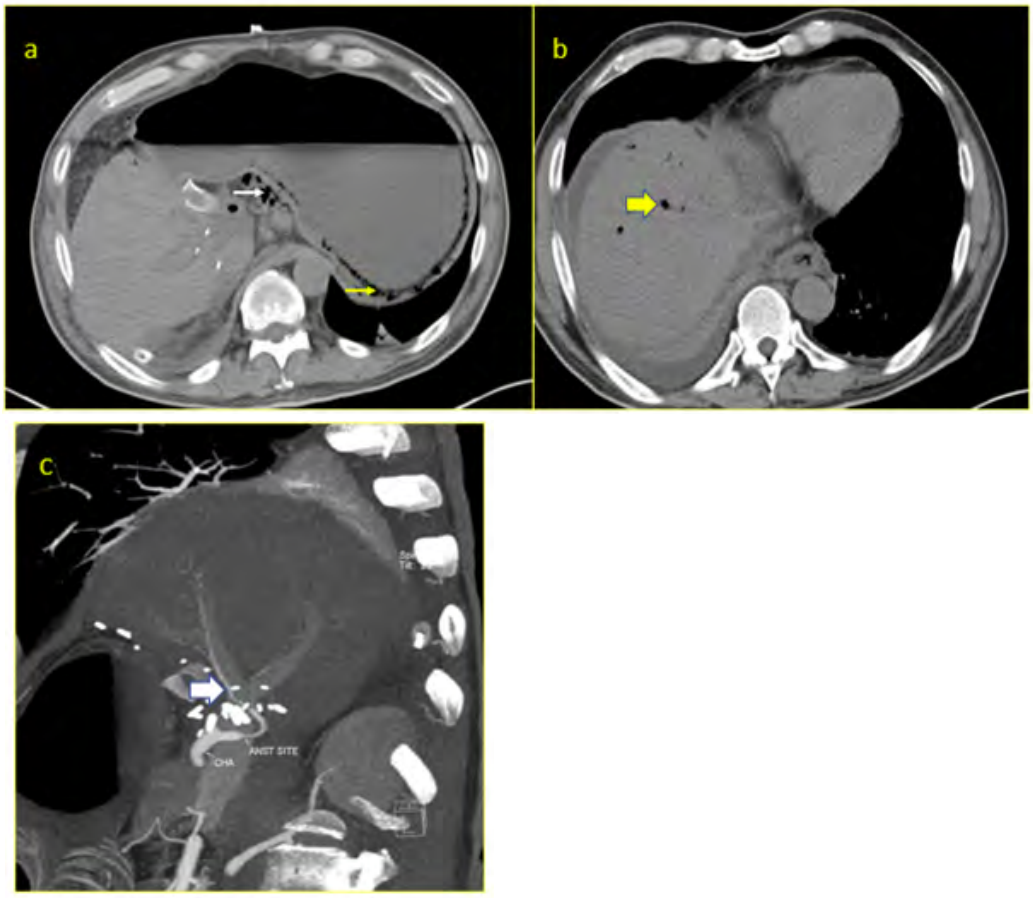

Figure 3: Post LDLT , 62/M (LAR-2) . Portal vein gas was detected on routine post operative doppler on POD-3 and POD-4. Plain CT of the upper abdomen on POD-4 (a, b) demonstrates intramural air in the stomach (yellow arrow) , in the peri gastric vessels (white arrow) and in the liver parenchyma (yellow block arrow). CT angiography was performed as the hepatic artery could not be evaluated due to the gas causing excessive spikes in the doppler spectrum. Oblique MIP image (c) shows maintained patency of the hepatic artery (white block arrow) and its divisions within the allograft. The patient was stable and subsequent doppler studies showed resolution of the portal vein air on POD -6 and resolution of the intramural gastric air on a follow up plain CT on POD- 7. A diagnosis of Gastric emphysema was made and the patient was later discharged in a stable condition.

Table 1: Summary of 5 patients with portal venous gas after liver transplantation.

		POD of PV gas detection	Resolution	Clinical presentation	Transaminase and bilirubin levels	Sepsis
LAR-1	56/M	POD 6	POD 7	Normal post-operative recovery	Stable	none
LAR-2	62/M	POD3,4,5	POD 6	Normal post-operative recovery	Stable	none
LAR-3	44/M	POD 4, 5	POD 6	Normal post-operative recovery	Decreasing trend	none
LAR-4	48/M	POD 3	POD4	Normal post-operative recovery	Decreasing trend	none
LAR-5	50/M	POD 5	POD 6	Normal post-operative recovery	Decreasing trend	none

LAR- Liver Allograft Recipient

4. Discussion

Intra hepatic gas in liver allograft recipients can have a number of causes and needs to be carefully assessed. The most serious of these is hepatic artery thrombosis leading to biliary ischaemia and necrosis with formation of bile lakes and abscesses with gas [5, 6]. A catastrophic situation is that of hepatic artery thrombosis leading to gas gangrene; hepatic abscess with gram negative bacteria can also lead to hepatic parenchymal gas [5, 6, 7]. While the above conditions in a post liver transplant scenario present with hepatic parenchymal gas, portal venous gas is a distinct entity.

Chezmar et al [2] reported sonographic detection of early, transient portal venous or mesenteric gas in 18% of transplanted livers. Gas was identified up to 8 days after surgery and resolved within 1–9 days after detection. While some patients had associated conditions of sepsis, adynamic ileus, clostridium difficile colitis, one patient had graft failure requiring re-transplant. But neither bowel ischaemia nor infarction was present in any of the patients.

The pathogenesis of gas in the PV is believed to be either due to bowel distention, obstruction or bowel wall ulceration leading to infiltration of gas in the bowel venules and then into the PV or due to bacteria traversing a damaged intestinal wall [8, 9]. Shigato, et al, in 2012 [10] described PV gas on sonography in three patients who had undergone LDLT. All the three patients had developed intraabdominal complications at the time of PV gas detection and had shown a positive bacterial blood culture. Hence, they concluded that PV gas in the post-transplant period could represent bacterial translocation.

PV gas presents in the form of mobile fast drifting small echoes in the PV and its branches extending into the liver parenchyma along the portal branches. LaFortune, et al [9] described the sonographic appearance of gas in PV in three patients and in their experimental study of injection of gas in the jejunal veins of nine dogs. In both the groups, doppler study and sonography yielded hyperechogenic foci moving within the PV with a sharp bidirectional spike superimposed over the normal tracing. In all the three patients with PV gas detected on sonography, CT did not demonstrate gas either in the PV or in the liver parenchyma. Sonographically, both PV gas and pneumobilia can present in the form of linear or branching echoes and it is important to differentiate between the two [8,11]. Pneumobilia is confined to the central liver and there is often an associated history of biliary intervention in the form of ERCP or biliary stenting {11}. PV gas is detected in the form of 'moving bright reflectors' in real time imaging within the PV, and also extends to the periphery in the form of peripheral parenchymal reflexes caused by gas in the PV branches moving along the flow direction into the parenchyma [8,11]. All our patients had the classic sonographic findings of echoes within the PV and its branches extending to the periphery with the irregular superimposed bidirectional spikes on doppler tracing. When detected following a surgery or procedure and in the absence of any clinical or imaging evidence of bowel ischaemia, PV gas is a non-threatening condition not warranting surgical exploration or intervention [3, 4]. We conclude that in the absence of clinical and imaging evidence of bowel ischaemia or bacteremia, and when hepatic arterial flow is well preserved, PV gas in the post-operative period of liver transplantation is benign, transient and self-resolving and does not necessarily signify allograft ischaemia, failure or rejection.

References

1. Schindera ST, Triller J, Vock P, Hoppe H. Detection of hepatic portal venous gas: its clinical impact and outcome. Emerg Radiol. 2006; 12(4): 164-70.
2. Chezmar JL, Nelson RC, Bernardino ME. Portal venous gas after hepatic transplantation: sonographic detection and clinical significance. AJR Am J Roentgenol. 1989; 153(6): 1203-5.
3. Nelson AL, Millington TM, Sahani D, Chung RT, Bauer C, Hertl M, et al. Hepatic portal venous gas: the ABCs of management. Arch Surg. 2009; 144(6): 575-81.
4. Sebastia C, Quiroga S, Espin E, Boye R, Alvarez-Castells A, Armengol M, et al. Portomesenteric vein gas: pathologic mechanisms, CT findings, and prognosis. Radiographics. 2000; 20(5): 1213-24.
5. Bhargava P, Vaidya S, Dick AA, Dighe M. Imaging of orthotopic liver transplantation: review. AJR Am J Roentgenol. 2011; 196(3 Suppl): WS15-25 Quiz S35-8.
6. Shah PA, Cunningham SC, Morgan TA, Daly BD. Hepatic gas: widening spectrum of causes detected at CT and US in the interventional era. Radiographics. 2011; 31(5): 1403-13.
7. Girometti R, Como G, Bazzocchi M, Zuiani C. Post-operative imaging in liver transplantation: state-of-the-art and future perspectives. World J Gastroenterol. 2014; 20(20): 6180-200.
8. Benson LABaCB. Sonographicaily Detected Portal Venous Air Secondary to Bowel Ischemia. Journal of Diagnostic Medical Sonography. 1994; 10(6): 322-4.

9. Lafortune M, Trinh BC, Burns PN, Breton G, Burke M, Dery R, et al. Air in the PV: sonographic and Doppler manifestations. Radiology. 1991; 180(3): 667-70.

10. Shigeta T, Sakamoto S, Nosaka S, Fukuda A, Kanazawa H, Uchida H, et al. Detection of Portal Venous Gas by Ultrasonography after Liver Transplantation: A Possible Early Sign of Bacterial Translocation. Open Journal of Organ Transplant Surgery. 2012; 2(3): 14-7.

11. Trenker C, Görg C, Dong Y, Cui XW, Zadeh ES, Alhyari A, et al. Portal venous gas detection in different clinical situations. Med Ultrason. 2023.