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CASE REPORT

Salvage Liver Transplantation for Hepatic Gas Gangrene

David Jérémie Birnbaum · Emilie Grégoire · Jean Hardwigsen · Yves Patrice Le Treut

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Abstract Hepatic gas gangrene is an uncommon situation mainly due to bacterial infection by *Clostridium perfringens*. It remains a life-threatening condition associated with a high mortality rate. Quick diagnosis and aggressive therapy including liver transplantation should be proposed to improve the outcome. This report describes a rare case of hepatic gas gangrene on native liver, secondary to iatrogenic hepatic artery thrombosis and instrumental biliary tree infection, which was successfully treated by liver transplantation.

Keywords Gas gangrene · Ischemic cholangitis · Hepatic artery thrombosis · Biliary stent · Liver transplantation

Abbreviations

LT	Liver transplantation
POD	Postoperative day
ERCP	Endoscopic retrograde cholangiopancreaticography
CT scan	Contrast-enhanced computed tomography scan

Introduction

Hepatic gas gangrene is a rapidly spreading infection of the liver caused by pathogenic spore-bearing anaerobic bacteria responsible for necrosis and edema. *Clostridium perfringens* is the most frequently identified offending agent, but group A *Streptococcus* and *Staphylococcus aureus* and *Vibrio vulnificus* may cause similar manifestations.[1] Gas gangrene classically occurs after abdominal surgery, penetrating trauma, or in the setting of skin and soft tissue infection in diabetic patients.[1] Although prognosis is generally poor, favorable outcome can be obtained with early recognition and rapid treatment using antibiotics and emergency surgery. Hepatic gas gangrene is an uncommon event and can occur in the post-liver transplantation course in the case of hepatic artery thrombosis. This report describes a rare case of hepatic gas gangrene on native liver, secondary to iatrogenic hepatic artery thrombosis, and instrumental biliary tree infection, which was successfully treated by liver transplantation (LT).

Case Report

A 9-cm aneurysm of the proper hepatic artery was discovered incidentally in a 57-year-old man on ultrasound and confirmed on contrast-enhanced computed tomography scan (CT scan). The patient underwent resection of the aneurysm in another center, and a reconstruction of the hepatic artery was performed by saphenous vein graft interposition. To facilitate exposure, the liver was mobilized and the falciform ligament and left and right triangular ligaments were sectioned. The pericholedochal arterial network was lost during the surgical cure of the aneurysm due to the complete dissection of the proper hepatic artery. Cholecystectomy

D. J. Birnbaum · E. Grégoire · J. Hardwigsen · Y. P. Le Treut
Aix-Marseille Univ 13284 Marseille, France & Assistance-Publique Hôpitaux de Marseille, Department of Digestive Surgery and Liver Transplantation, Hopital de La Conception, 13005 Marseille, France

D. J. Birnbaum (✉)
Département de Chirurgie Digestive et de Transplantation Hépatique, Hôpital de la Conception,
CHU, 156 Bd Baille,
13005 Marseille, France
e-mail: david.birnbaum10@gmail.com

was performed to avoid ischemic cholecystitis. Intraoperative cholangiography was not performed. In the early postoperative period, the patient developed ischemic cholangitis secondary to saphenous vein graft thrombosis and progressive necrosis of the left liver associated with a biliary fistula. The abdominal drain produced 500 mL/day of bile. Cholangio-magnetic resonance imaging demonstrated an ischemic cholangitis mainly located in the left lateral lobe. At postoperative day (POD) 10, an endoscopic retrograde cholangiopancreatography (ERCP) failed to identify the origin of the biliary fistula. An aberrant duct feeding the gallbladder bed was suspected and a biliary stent was placed in the right biliary duct. A septic shock followed the ERCP. Bacteriological testing on a bile sample revealed a multiresistant *Klebsiella* infection. Treatment with antibiotics and removal of the biliary stent did not lead to any clinical improvement; the biliary fistula continued to be productive (800 mL/24 h). Progressive liver failure (prothrombin ratio (PT), 35 %; factor V, 59 %; total bilirubin, 129 μmol/L; aspartate amino tranferase, 134 UI/L; alanine amino transferase, 354 UI/L), encephalopathy, and sepsis required intensive care management. A new CT scan suggested hepatic gas gangrene located in the upper part of the left and right liver (Fig. 1a, b). The patient was referred to our department. Surgical exploration revealed spongious alteration and necrosis of the hepatic dome. A sequestrectomy was performed to remove the necrotic tissue. In the postoperative course, the patient presented signs of septic shock and liver function continued to deteriorate (PT<30 %, bilirubin> 150 μmol/L). CT scan showed a heterogeneous liver with multiple necrotic areas outside the sequestrectomy area, the absence of hepatic arterial flow, and a permeable portal system. Emergency LT was performed on POD 30. The MELD score at the time of LT was 32. The recipient inferior vena cava was preserved and liver graft was implanted using a conventional cavo-caval anastomosis. No graft liver complications occurred, and liver function factors became normal after LT. The patient was discharged on POD 137 after LT. The post-LT course was marked by several complications, including pulmonary atelectasis requiring bronchoscopy, renal insufficiency, thrombocytopenia and hemolytic anemia requiring plasma exchange, and diverticular bleeding requiring emergency left colectomy with temporary colostomy. Follow-up at 3 years demonstrated normal liver function.

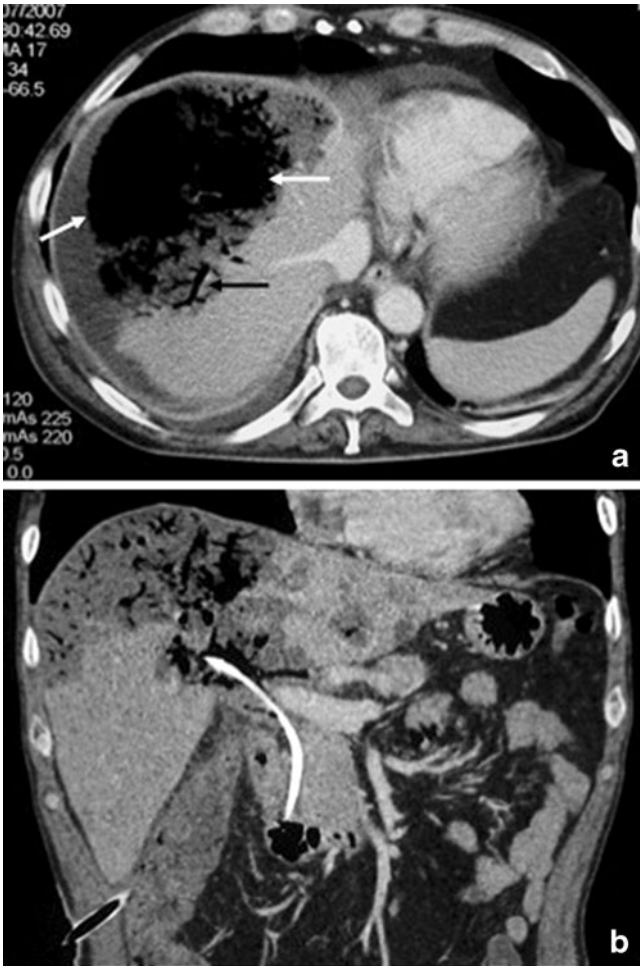

Fig. 1 Computed tomography scan of the abdomen demonstrating hepatic gas gangrene (*white arrow*) with aerobilia (*black arrow*). **a** Coronal plane. **b** Sagittal plane

Discussion

Hepatic gas gangrene is a rare infection that constitutes a therapeutic emergency. This phenomenon is attributed to an acute devitalization of the liver combined with the colonization by anaerobic germs through the portal vein or the biliary tract (bilio-digestive anastomosis, biliary stent). The most frequent offending organisms are clostridia, but other pathogens with gas-forming potential (*Escherichia coli* and *Klebsiella pneumoniae*) can produce similar clinical manifestations. In our case, *K. pneumoniae* was found in the bile sample analysis.[1] Most of the time, hepatic gas gangrene occurs in a post-transplant setting of early hepatic artery thrombosis, leading to liver graft failure, graft loss, and a significant increase in postoperative mortality.[2] Treatment generally requires reinterventions and sometimes retransplantation,[3–5] with a mortality rate of 27 % in the case of retransplantation and 73 % without retransplantation.[6,7] Arterial vascularization is primarily insured by the hepatic artery, but also by other numerous blood supplies, in particular the pericholedochal arterial network, depending on the gastroduodenal artery.[8] These two main arterial networks are anastomotic at the level of the hilar plate,[9] which explains why arterial ischemia of a native liver is very rare. Liver transplantation entails the sacrifice of the pericholedochal contribution in such a way that hepatic artery thrombosis

results in an ischemic cholangitis, which can lead to secondary complications such as biliary fistula, bilioma, and intrahepatic abscess, requiring emergency liver retransplantation.[3,6,10,11] In our patient, one of the factors favoring ischemic cholangitis after hepatic artery thrombosis was the loss of pericholedochal arterial network during the surgical cure of the aneurysm due to the complete dissection of the proper hepatic artery. When the patient was referred to our department, the parenchyma was already ischemic and the hepatic necrosis had spread too extensively, making any revascularization attempt impossible. Sequestrectomy was the only surgical option. The other primary condition for gas gangrene is the liver colonization by anaerobic bacteria. In the present case, this colonization was due to the biliary stent set up to treat the fistula, which allowed bacteria to migrate from the digestive tract to the liver. Classically, infection is a contraindication for LT, unless the septic site can be removed during LT.[12] Nevertheless, few cases of successful retransplantation for hepatic gas gangrene after severe hepatic trauma have been reported.[12–14] Immediate inclusion on the waiting list was decided due to rapidly progressing sepsis and acute liver failure that was persistent despite partial hepatectomy. Our patient had a lengthy post-transplant course, with some unusual complications. We have no data to strictly correlate post-transplant unusual complications and the hepatic gas gangrene. However, this severe septic state preceding transplantation has probably placed the patient in a vulnerable situation and so may have increase postoperative complications. However, the favorable long-term outcomes indicate that LT can be a life-saving strategy in liver failure secondary to hepatic gas gangrene.

Conclusion

Hepatic gas gangrene on native liver is uncommon. It is a rare and devastating process that can occur after liver trauma or LT, most often following hepatic artery thrombosis. Aggressive management including antibiotics and rapid surgery is the gold standard in gas gangrene occurring in other locations. Few cases of treatment of hepatic gas gangrene by LT have been reported. Hepatic gas gangrene is not an absolute contraindication to LT provided that the septic site is completely removed during transplantation, which may represent a life-saving option.

Conflict of Interest The authors of this manuscript have no conflicts of interest to disclose as described by the Journal of Gastrointestinal Surgery.

References

1. Bessman, A. N., and W. Wagner.. Nonclostridial gas gangrene. Report of 48 cases and review of the literature. JAMA 1975; 233: 958-963.
2. Bekker, J., S. Ploem, and K. P. de Jong.. Early hepatic artery thrombosis after liver transplantation: a systematic review of the incidence, outcome and risk factors. Am J Transplant 2009; 9: 746-757.
3. Bhattacharjya, S., B. K. Gunson, D. F. Mirza, D. A. Mayer, J. A. Buckels, P. McMaster, and J. M. Neuberger.. Delayed hepatic artery thrombosis in adult orthotopic liver transplantation-a 12-year experience. Transplantation 2001; 71: 1592-1596.
4. Stange, B. J., M. Glanemann, N. C. Nuessler, U. Settmacher, T. Steinmuller, and P. Neuhaus.. Hepatic artery thrombosis after adult liver transplantation. Liver Transpl 2003; 9: 612-620.
5. Silva, M. A., P. S. Jambulingam, B. K. Gunson, D. Mayer, J. A. Buckels, D. F. Mirza, and S. R. Bramhall.. Hepatic artery thrombosis following orthotopic liver transplantation: a 10-year experience from a single centre in the United Kingdom. Liver Transpl 2006;12: 146-151.
6. Gunsar, F., N. Rolando, S. Pastacaldi, D. Patch, M. L. Raimondo, B. Davidson, K. Rolles, and A. K. Burroughs.. Late hepatic artery thrombosis after orthotopic liver transplantation. Liver Transpl 2003; 9: 605-611.
7. Tzakis, A. G., R. D. Gordon, B. W. Shaw, Jr., S. Iwatsuki, and T. E. Starzl. Clinical presentation of hepatic artery thrombosis after liver transplantation in the cyclosporine era. Transplantation 1985; 40: 667-671.
8. Terblanche, J., H. F. Allison, and J. M. Northover.. An ischemic basis for biliary strictures. Surgery 1983; 94: 52-57.
9. Stapleton, G. N., R. Hickman, and J. Terblanche.. Blood supply of the right and left hepatic ducts. Br J Surg 1998; 85: 202-207.
10. Doblecki-Lewis, S., E. Palaios, P. A. Bejarano, A. G. Tzakis, G. Selvaggi, and M. I. Morris.. Hepatic gas gangrene following orthotopic liver transplantation: three cases treated with re-transplantation and a review of the literature. Transpl Infect Dis 2008; 10: 280-285.
11. Itai, Y., and O. Matsui.. Blood flow and liver imaging. Radiology 1997; 202: 306-314.
12. Veroux, M., U. Cillo, A. Brolese, P. Veroux, C. Madia, P. Fiamingo, G. Zanus, A. Buffone, E. Gringeri, and D. F. D'Amico.. Blunt liver injury: from non-operative management to liver transplantation. Injury 2003; 34: 181-186.
13. Delis, S. G., A. Bakoyiannis, G. Selvaggi, D. Weppler, D. Levi, and A. G. Tzakis.. Liver transplantation for severe hepatic trauma: experience from a single center. World J Gastroenterol 2009; 15: 1641-1644.
14. Ginzburg, E., D. Shatz, M. Lynn, H. Pombo, M. Diaz, L. Martin, A. Livingstone, M. F. Khan, J. Nery, and A. Tzakis.. The role of liver transplantation in the subacute trauma patients. Am Surg 1998; 64: 363-364.