Radiology Case Reports 19 (2024) 2206–2210

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Successful coil embolization of post-hepatectomy arterioportal fistula that reduced ascites and improved liver function ☆,☆☆

Ryuta Okuhira, MD, Tetsuo Sonomura, MD, PhD, Ryota Tanaka, MD, PhD, Riki Inagaki, MD, Shota Ueda, MD, PhD, Kodai Fukuda, MD, Nobuyuki Higashino, MD, Atsufumi Kamisako, MD, PhD, Hirotatsu Sato, MD, PhD, Akira Ikoma, MD, PhD, Hiroki Minamiguchi, MD, PhD*

The Department of Radiology, Wakayama Medical University, Wakayama, Japan

ARTICLE INFO

Article history:
Received 13 February 2024
Accepted 14 February 2024

Keywords:
Embolization
Hepatic arterioportal fistula
Microcoil
Balloon catheter

ABSTRACT

A 71-year-old man had previously undergone S7 + S8 dorsal segmentectomy and S5 partial hepatectomy for hepatocellular carcinomas. Six months later, he experienced abdominal distention. Abdominal computed tomography (CT) showed massive ascites and a significant hepatic arterioportal shunt. The ascites was thought to be caused by portal hypertension due to a high-flow hepatic arterioportal fistula (HAPF). The fistula, located between the right hepatic artery A7 and the right portal vein, was embolized with microcoils under flow control using a balloon catheter. After embolization, the shunt blood flow disappeared and the hepatopetal venous flow was restored. His body weight and abdominal circumference decreased immediately, and his liver function on blood tests improved after the procedure. CT performed 11 days after embolization showed decreased ascites. A HAPF after hepatectomy is extremely rare. Balloon-assisted embolization using microcoils is a useful endovascular procedure for treating a high-flow HAPF.

Introduction

A hepatic arterioportal fistula (HAPF) is an abnormal communication between a hepatic artery and a portal vein. HAPF can lead to portal hypertension, which can cause serious complications such as ascites, hepatic encephalopathy, liver failure, and variceal hemorrhage [1–4]. HAPF is often treated by transcatheter inflow arterial embolization, which is a minimally invasive procedure [5–7]. Causes of HAPF include con-

☆ Acknowledgments: This study was not supported by any funding.
☆☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
* Corresponding author.
E-mail address: okuhirar@wakayama-med.ac.jp (R. Okuhira).
https://doi.org/10.1016/j.radcr.2024.02.052

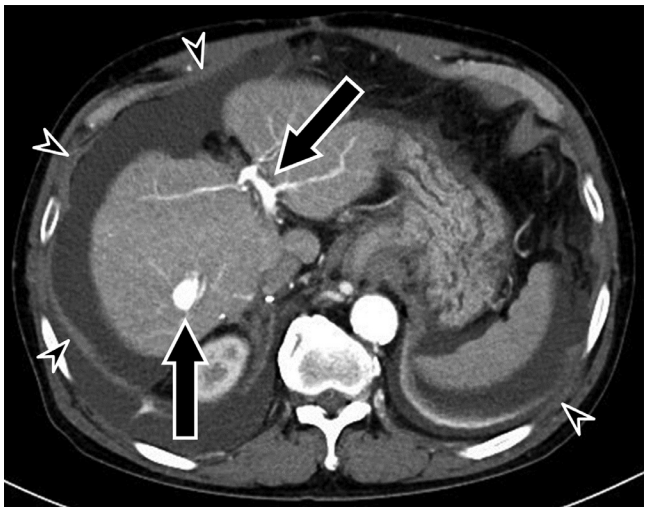


Fig. 1 – Pre-embolization contrast-enhanced computed tomography image (arterial phase) showing early enhancement of the portal vein (arrows) and massive ascites (arrowheads).

genital anomalies, trauma, malignancies, rupture of visceral aneurysm, and iatrogenic complications (biliary drainage, percutaneous hepatic puncture) [8–12]. However, HAPF after hepatectomy is extremely rare, and to our knowledge, there are only two published reports of HAPF after hepatectomy being successfully treated by embolization [13,14]. The present report describes a rare case of HAPF after surgical hepatectomy, in which coil embolization reduced ascites and improved hepatic function.

Case ReportA 71-year-old man had undergone S7 + S8 dorsal segmentectomy and S5 partial hepatectomy for hepatocellular carcinomas. The patient had hypertension, diabetes mellitus, and hypothyroidism. Three months after surgery, a computed tomography (CT) scan revealed portal vein enhancement early in the arterial phase, indicating a HAPF. At that time, he had no subjective symptoms, ascites, or decreased liver function; therefore, he was placed under observation. Six months after surgery, the patient visited our hospital because of abdominal distention. Plain and contrast-enhanced CT showed massive ascites and a HAPF (Fig. 1). Blood tests showed an elevated total bilirubin level (2.2 mg/dL), a decreased albumin level (2.7 g/dL), and a decreased prothrombin time (ratio; 56.2%), indicating decreased liver function. He was referred to our department for endovascular treatment of portal hypertension caused by the HAPF.

Angiography was performed for diagnosis and to guide treatment. A 5 Fr. sheath (Terumo, Tokyo, Japan) was inserted through the right common femoral artery. CT during aortography revealed a shunt between the right hepatic artery A7 and the dorsal portion of the right portal vein (Fig. 2). Because the blood flow through the fistula was very fast, a balloon catheter (Selecon MP Catheter II; 9 mm diameter, Terumo, Tokyo, Japan) was inserted into the proper hepatic artery for flow control. A microcatheter (1.9/2.8 Fr Tellus 125 cm, Asahi Intecc, Aichi, Japan) was inserted into the right hepatic artery A7. Selective angiography of A7 under flow control using the balloon

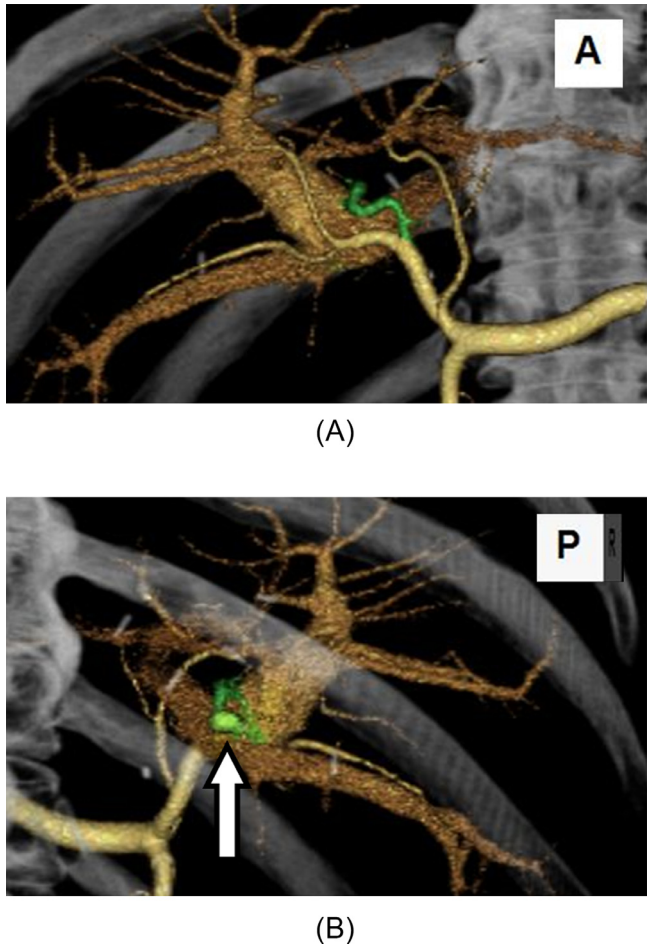
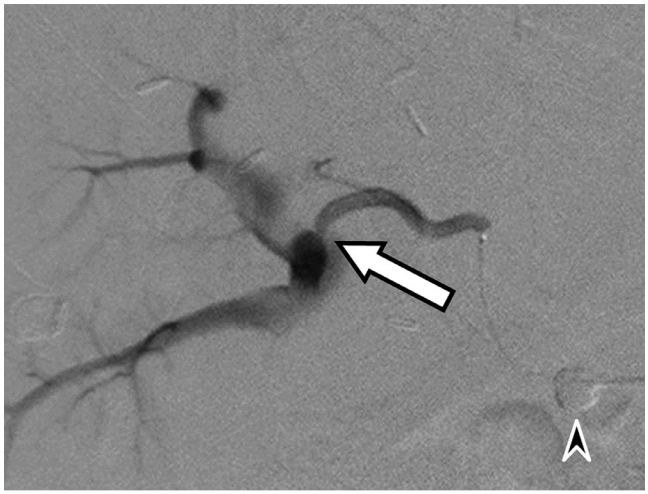


Fig. 2 – Volume-rendered images (A: frontal view, B: right posterior oblique view) created from computed tomography during aortography showing the fistula (arrow) between the right hepatic artery A7 (green) and the dorsal portion of the right portal vein.

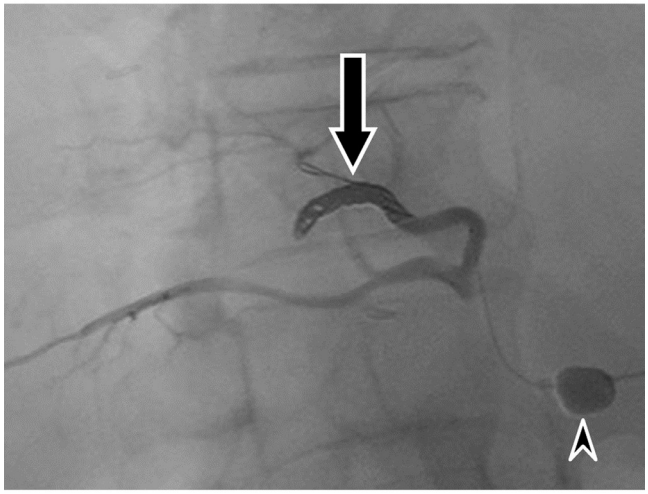
catheter clearly depicted the shunt point (Fig. 3A). The shunt point and A7 were embolized with 7 microcoils (Fig. 3B). After embolization, the HAPF disappeared, and CT during arterial portography showed restoration of the hepatopetal blood flow (Fig. 4). The patient's body weight and abdominal circumference promptly decreased after embolization, and his abdominal distention improved (Fig. 5A). Blood tests showed improved liver function markers (Fig. 5B). A CT scan performed 11 days after embolization showed decreased ascites.

Discussion

Guzman et al. classified HAPF into three types [15]. Type 1 is a small peripheral fistula, which is asymptomatic and can be expected to resolve spontaneously. Type 2 is a large proximal fistula, in which a large amount of arterial blood flows directly into the portal vein, causing portal hypertension. Because it carries a risk of irreversible hepatic fibrosis, a therapeutic

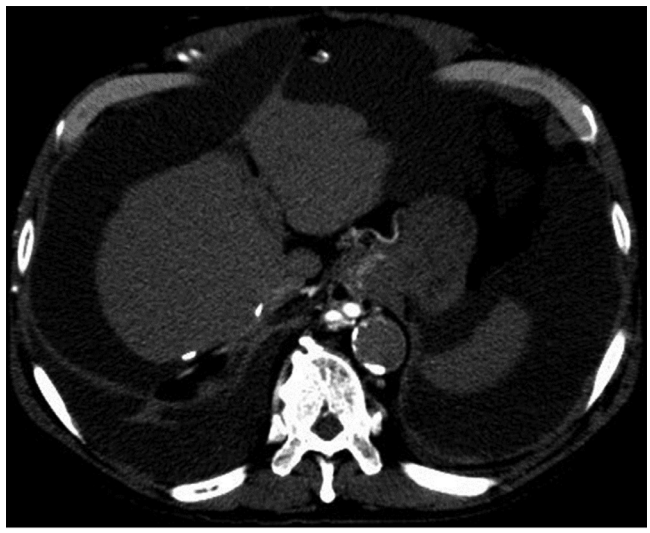


(A)

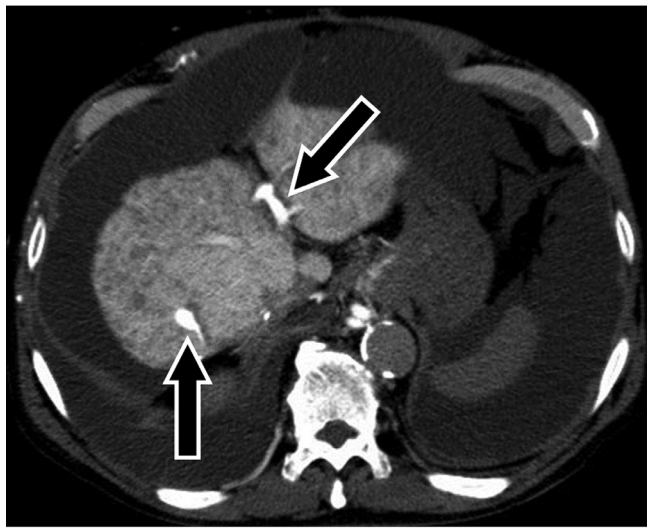


(B)

Fig. 3 – Selective angiography of A7 under flow control using a balloon catheter (arrowhead). (A) Preoperative angiography showing the fistula (white arrow) between the right hepatic artery A7 and the right portal vein, which features a constriction. (B) The fistula and hepatic artery A7 were embolized with seven microcoils (black arrow), and postoperative angiography shows complete occlusion of the shunt.



(A)



(B)

Fig. 4 – Compted tomography during arterial portography (CTAP) before and after embolization. (A) Pre-embolization CTAP showing the absence of portal inflow due to the increased portal venous pressure caused by the hepatic arterioportal fistula. (B) CTAP immediately after embolization showing restoration of hepatopetal blood flow.

intervention is required. Type 3 is congenital, forming a diffuse fistula in the liver.

The causes of HAPF are diverse, but they are extremely rare after hepatic resection. To our knowledge, there have been only 2 reported cases of transcatheter embolization for HAPF after hepatic resection [13,14]. Those cases and the present case were treated by metallic coil embolization. In this case, a type 2 HAPF was identified 3 months after hepatectomy, and the patient's symptoms and liver dysfunction appeared 6 months later. Although there are no current reports describing the natural history of HAPF after hepatic resection, a large type 2 HAPF is very unlikely to close spontaneously due to the fast and massive blood flow through the shunt. Therefore, it may be important to perform noninvasive transcatheter treatment of a type 2 HAPF before the onset of symptoms and irreversible liver failure.

In this case, the shunt blood flow was so fast that clear images could not be obtained by free-flow angiography. Therefore, balloon occlusion was performed at the proper hepatic artery to reduce hepatic blood flow. This allowed us to accurately depict the vascular anatomy and shunt point and to design an effective treatment strategy. In addition, coil embolization was performed under flow control using a balloon

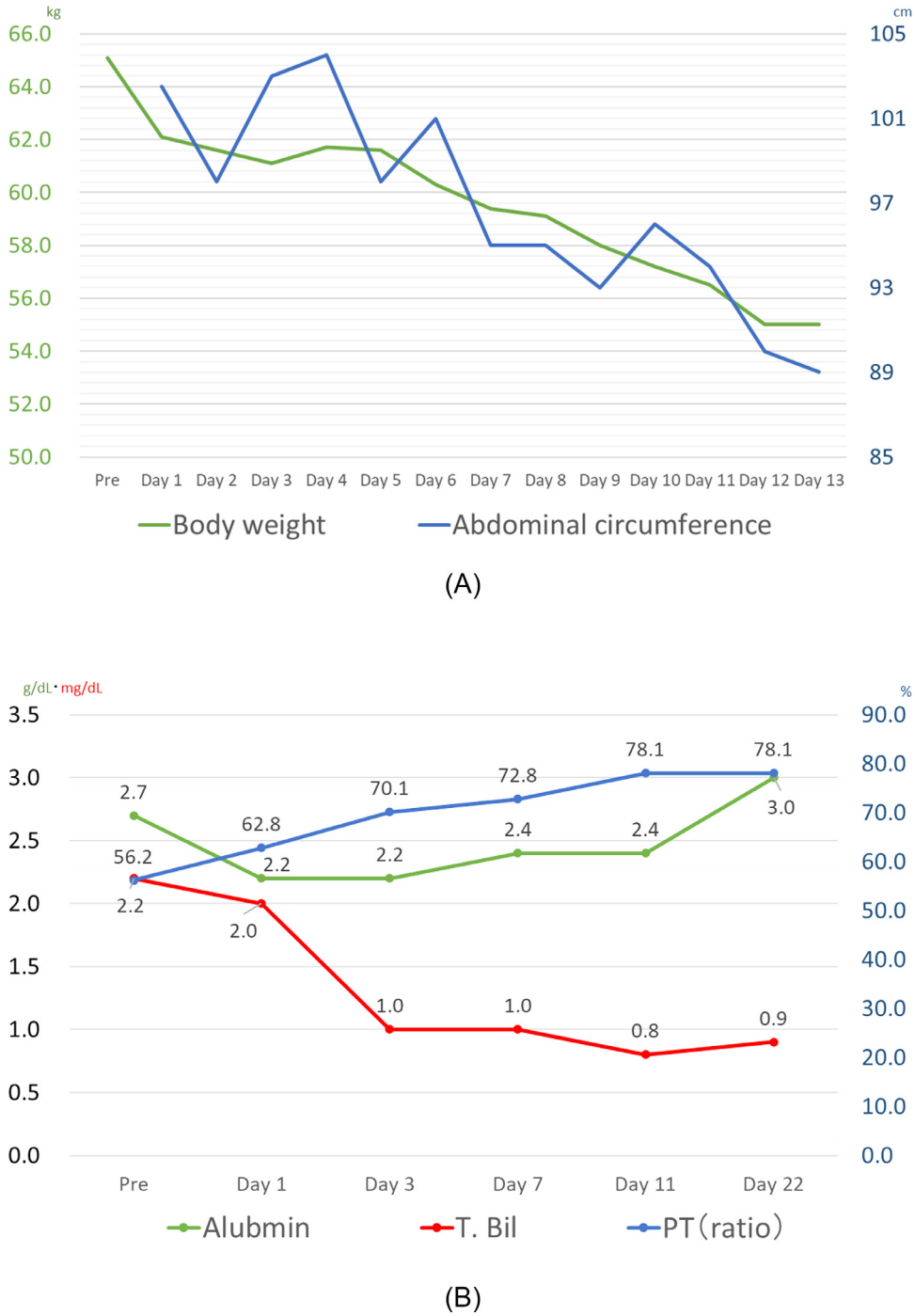


Fig. 5 – Post-embolization course. (A) Body weight (green) and abdominal circumference (blue) decreased immediately after embolization, indicating a decrease in ascites. (B) On day 22 after embolization, the albumin level (green) and prothrombin time (ratio; blue) increased, and the total bilirubin level (red) decreased. These results indicate an improvement of liver function.

catheter, which allowed us to achieve tight embolization and avoid coil migration into the portal vein. In this case, coils were useful as an embolic material because there was constriction of the shunt. A liquid embolic material, such as *n*-butyl-2-cyanoacrylate (nBCA), would have been required in the absence of a constriction. In such cases, it is necessary to inject dense nBCA under balloon flow control to prevent the migration of nBCA into the portal vein [16]. Flow control using a balloon catheter may be useful for embolization of a type 2 HAPF.

Conclusion

A HAPF after hepatectomy is extremely rare, and balloon-assisted embolization using metallic coils is a useful endovascular treatment for a type 2 HAPF with a constriction.

Patient consent

The patient provided informed consent for preparation and publication of this case report.

REFERENCES

[1] Vauthey JN, Tomczak RJ, Helmberger T, Gertsch P, Forsmark C, Caridi J, et al. The arterioportal fistula syndrome: clinicopathologic features, diagnosis, and therapy. Gastroenterology 1997;113(4):1390–401. doi:10.1053/gast.1997.v113.pm9322535.

[2] Hori T, Ueda M, Oike F, Ogura Y, Ogawa K, Nguyen JH, et al. Graft loss and poor outcomes after living-donor liver transplantation owing to arterioportal shunts caused by liver needle biopsies. Transplant Proc 2010;42(7):2642–4. doi:10.1016/j.transproceed.2010.04.032.

[3] Nookala A, Saberi B, Ter-Oganesyan R, Kanel G, Duong P, Saito T. Isolated arterioportal fistula presenting with variceal hemorrhage. World J Gastroenterol 2013;19(17):2714–17. doi:10.3748/wjg.v19.i17.2714.

[4] Kuroda H, Hosho K, Koda M, Murawaki Y, Ouchi Y, Kaminou T, et al. Idiopathic intrahepatic arterioportal fistula treated by hepatectomy assisted by balloon-occluded retrograde transvenous obliteration: report of an elderly case. Hepatol Res 2008;38(8):847–50. doi:10.1111/j.1872-034X.2008.00341.x.

[5] Lumsden AB, Allen RC, Sreeram S, Atta H, Salam A. Hepatic arterioportal fistula. Am Surg 1993;59(11):722–6. doi:10.1097/00000478-199311000-00018.

[6] Noorbakhsh S, Gomez L, Joung Y, Meyer C, Hanos DS, Freedberg M, et al. Hepatic arterioportal fistula following liver trauma: case series and review of the literature. Vasc Endovascular Surg 2023;57(7):749–55. doi:10.1177/15385744231165155.

[7] Chandel K, Patel RK, Tripathy TP, Mukund A, Maiwall R, Sarin SK. Hepatic arterioportal fistula in patients with cirrhosis with endovascular management-a series of 4 cases with review of literature. Indian J Radiol Imaging 2022;32(1):136–41. doi:10.1055/s-0042-1743112.

[8] Zhang DY, Weng SQ, Dong L, Shen XZ, Qu XD. Portal hypertension induced by congenital hepatic arterioportal fistula: report of four clinical cases and review of the literature. World J Gastroenterol 2015;21(7):2229–35. doi:10.3748/wjg.v21.i7.2229.

[9] Wu H, Zhao W, Zhang J, Han J, Liu S. Clinical characteristics of hepatic Arterioportal shunts associated with hepatocellular carcinoma. BMC Gastroenterol 2018;18(1):174. doi:10.1186/s12876-018-0899-3.

[10] Cao B, Tian K, Zhou H, Li C, Liu D, Tan Y. Hepatic arterioportal fistulas: a retrospective analysis of 97 cases. J Clin Transl Hepatol 2022;10(4):620–6. doi:10.14218/JCTH.2021.00100.

[11] Okumura K, Kobayashi S, Ogi T, Sugiura T, Zhang Y, Kanatani M, et al. Transcatheter arterial embolization of iatrogenic massive arterioportal fistula in the liver. Acta Radiol 2022;63:867–76. doi:10.1177/02841851211023995.

[12] Han P, Yang L, Huang XW, Zhu XQ, Chen L, Wang N, et al. A traumatic hepatic artery pseudoaneurysm and arterioportal fistula, with severe diarrhea as the first symptom: a case report and review of the literature. Medicine (Baltimore) 2018;97(7):e9893. doi:10.1097/MD.0000000000009893.

[13] Kimura Y, Hori T, Machimoto T, Ito T, Hata T, Kadokawa Y, et al. Portal vein aneurysm associated with arterioportal fistula after hepatic anterior segmentectomy: thought-provoking complication after hepatectomy. Surg Case Rep 2018;4(1):57. doi:10.1186/s40792-018-0465-9.

[14] Davenport M, Redkar R, Howard ER, Karani J. Arterioportal hypertension: a rare complication of partial hepatectomy. Pediatr Surg Int 1999;15(8):543–5. doi:10.1007/s003830050666.

[15] Guzman EA, McCahill LE, Rogers FB. Arterioportal fistulas: introduction of a novel classification with therapeutic implications. J Gastrointest Surg 2006;10(4):543–50. doi:10.1016/j.gassur.2005.06.022.

[16] Sonomura T, Kawai N, Kishi K, Ikoma A, Sanda H, Nakata K, et al. N-butyl cyanoacrylate embolization with blood flow control of an arterioportal shunt that developed after radiofrequency ablation of hepatocellular carcinoma. Korean J Radiol 2014;15(2):250–3. doi:10.3348/kjr.2014.15.2.250.