

Radiological Findings in a Case of Multiple Focal Nodular Hyperplasia Associated with Portal Vein Atresia and Portopulmonary Hypertension

In Joon Lee, MD¹
Sook-Hyang Jeong, MD²
Jin Woo Choi, MD¹
Hee Sun Park, MD¹
Kyoung Ho Lee, MD¹
Haeryoung Kim, MD³

We present here the radiological findings of a rare case of multiple focal nodular hyperplasia that was associated with portal vein atresia and portopulmonary hypertension in a young woman. This case illustrates and supports the pathophysiological hypotheses that were previously proposed for the coexistence of these three abnormalities.

Index terms:

Focal nodular hyperplasia
Portal vein atresia
Pulmonary hypertension
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¹Department of Radiology, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Institute of Radiation Medicine, Seoul National University Medical Research Center, Gyeonggi-do 463-707, Korea;

²Department of Internal Medicine, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Gyeonggi-do 463-707, Korea;

³Department of Pathology, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Gyeonggi-do 463-707, Korea

Address reprint requests to:

Sook-Hyang Jeong, MD, Department of Internal Medicine, Seoul National University Bundang Hospital, 300 Gumi-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-707, Korea.
Tel. (8231) 787-7034
Fax. (8231) 787-7052
e-mail: jsh@snuhb.org

Although the pathogenesis of focal nodular hyperplasia (FNH) is not well understood, the general consensus is that hepatic vascular abnormality plays an important role in its development (1, 2). Herein we present a rare case of multiple FNH that was associated with portal vein atresia and portopulmonary hypertension in a young female patient.

CASE REPORT

A 30-year-old woman was admitted to our hospital to further evaluate her hepatic nodules. She had experienced dyspnea on exertion since the time of attending middle school. She had been diagnosed as having pulmonary hypertension and multiple liver nodules ten years earlier. She has been treated with diuretics, calcium channel blockers and sildenafil. She had experienced transient aggravation of her dyspnea one week before her recent delivery. Her platelet count was 99,000/mm³. Blood chemistry tests showed normal levels of transaminases, alkaline phosphatase and bilirubin. The serologic markers for hepatitis B and C virus were negative. Chest radiography (Fig. 1A) showed enlarged pulmonary arteries and cardiomegaly.

Ultrasonography showed numerous hyperechoic and isoechoic nodules of various sizes in the liver. On CT, the liver showed heterogeneous contrast enhancement due to the numerous nodules (Fig. 1B). These nodules were heterogeneously hyperattenuating during hepatic arterial phase, and they showed contrast material washout during the portal venous phase. Persistent central scar-like enhancement was found in some of the nodules. The hepatic arteries were hypertrophied. The portal vein was not visualized; however, splenic varix and splenorenal shunt were present.

The hepatic nodules had high signal intensity with central portions of low signal intensity on the T1 weighted magnetic resonance images, and the hepatic nodules were of low signal intensity with central portions of high signal intensity on the T2 weighted images (Fig. 1C). On the gadolinium enhanced dynamic MR scans, the central hypointense portions of the nodules were filled with contrast media for a length of time and they showed persistent intense enhancement (Fig. 1D). On the gradient echo sequence images obtained after superparamagnetic iron oxide enhance-

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ment, the nodules showed a drop in signal intensity except at their central portions (Fig. 1E).

The patient underwent percutaneous ultrasound-guided needle biopsy. The biopsied tissue core demonstrated a dense fibrous septum containing numerous vascular structures at low power (Fig. 1G). Higher power magnification of the portal tracts revealed thick-walled vessels, and some had eccentric thickening. The surrounding hepatic parenchyma had slightly increased cellularity, with increased liver cell plate thickness. These findings were consistent with FNH.

Additional abdominal angiographies were obtained

during the diagnostic cardiography to evaluate her cardiac function. Hepatic arteriography showed numerous stained nodules in the liver with hypertrophied hepatic arteries. The delayed phase of the superior mesenteric arteriography showed the absence of the main portal vein flow, and the portosystemic collaterals drained into the inferior vena cava (Fig. 1F).

DISCUSSION

In this case, we observed the coexistence of multiple FNH, portal vein atresia and portopulmonary hyperten-

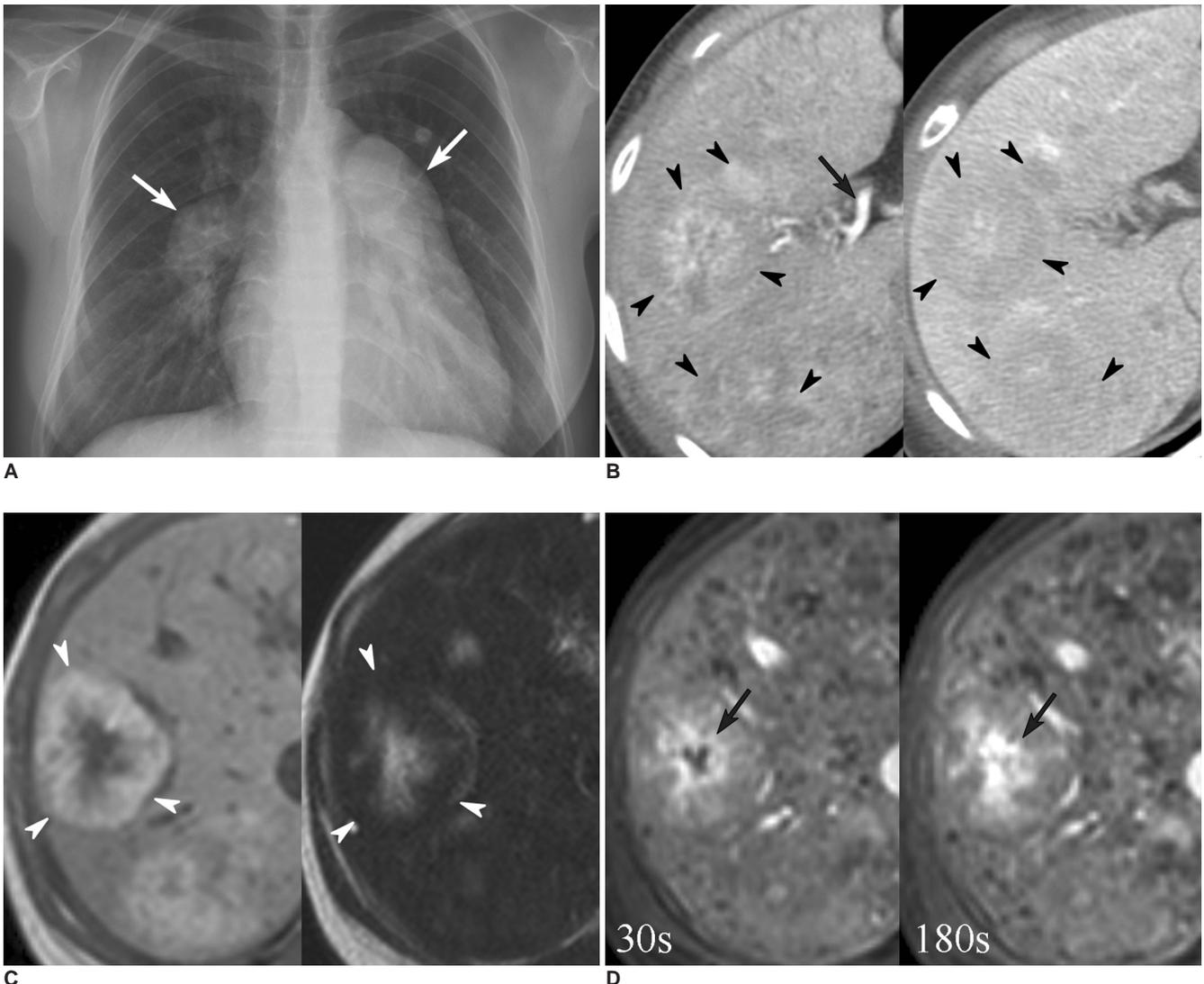


Fig. 1. 30-year-old woman with multiple focal nodular hyperplasia, portal vein atresia and portopulmonary hypertension.

A. Chest radiography shows enlarged pulmonary arteries (arrows) and cardiomegaly.

B. Arterial (left side) and delayed (right side) phase CT images show multiple nodules (arrowheads) in liver. Note hypertrophied hepatic artery (arrow) and portal vein at hepatic hilum is not visualized.

C. Lesions (arrowheads) show peripheral hyperintensity with central hypointense portion on T1-weighted image (left side) and they show peripheral hypointensity with central hyperintense portion on T2-weighted fast spin echo image (right side).

D. On gadolinium enhanced dynamic MR scans, central hypointense portion of nodule (arrows) is filled with contrast media for length of time and they show persistent intense enhancement.

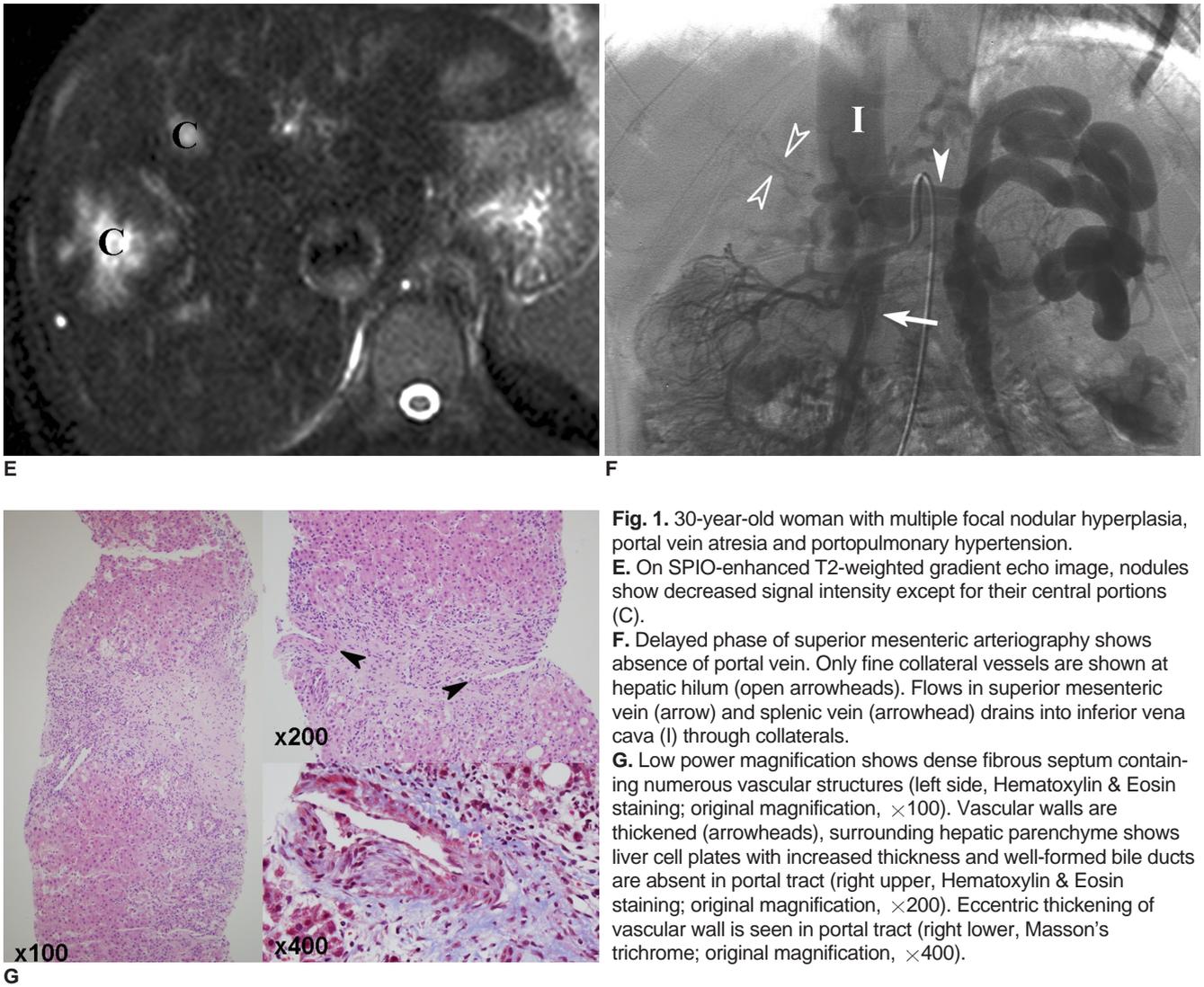


Fig. 1. 30-year-old woman with multiple focal nodular hyperplasia, portal vein atresia and portopulmonary hypertension.
E. On SPIO-enhanced T2-weighted gradient echo image, nodules show decreased signal intensity except for their central portions (C).
F. Delayed phase of superior mesenteric arteriography shows absence of portal vein. Only fine collateral vessels are shown at hepatic hilum (open arrowheads). Flows in superior mesenteric vein (arrow) and splenic vein (arrowhead) drains into inferior vena cava (I) through collaterals.
G. Low power magnification shows dense fibrous septum containing numerous vascular structures (left side, Hematoxylin & Eosin staining; original magnification, $\times 100$). Vascular walls are thickened (arrowheads), surrounding hepatic parenchyme shows liver cell plates with increased thickness and well-formed bile ducts are absent in portal tract (right upper, Hematoxylin & Eosin staining; original magnification, $\times 200$). Eccentric thickening of vascular wall is seen in portal tract (right lower, Masson's trichrome; original magnification, $\times 400$).

sion. There have been several case reports describing similar combinations of two or three (3) of these abnormalities.

Multiple FNH syndrome has been described and this refers to multiple FNH in combination with liver hemangiomas and vascular malformations, including hepatic arterial dysplasia, portal vein atresia and aneurysms of the brain, or pulmonary arterial hypertension and/or intracranial tumors (1).

For the association between multiple FNH and portal vein atresia (1, 4–7), it has been postulated the latter can play a role in the development of the former since a decreased portal flow can alter the delivery of hepatotrophic factors that affect the hepatic regenerative capacity, while the increased compensatory hepatic arterial flow can also contribute to the development of nodular hepatocellular lesions such as FNH, regenerative nodular hyperplasia and large non-cirrhotic regenerative nodules

(8–10).

For the association between portal vein atresia and pulmonary hypertension, it has been suggested that vasoactive substances bypassing the liver through portosystemic collaterals can cause pulmonary arterial spasm and thrombosis, which is a condition called portopulmonary hypertension (11). The main clinical presentation of portopulmonary hypertension is hemodynamic failure and the severity of portopulmonary hypertension may not parallel the severity of liver failure; this is different from hepatopulmonary syndrome, which is another pulmonary vascular disorder that occurs with portal hypertension (12).

For the association between FNH and pulmonary hypertension, it has been suggested that chronic congestion of the hepatic sinusoids can prolong the exposure of the liver to blood-borne hepatotrophic substances that induce a hyperplastic response of the hepatic parenchyme, and

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this stimulates the growth of nodular hepatocellular lesions such as FNH, which is a compensatory vicious cycle (3).

In our case, the chronological or causative relationships are not clear between the multiple FNH, portal vein atresia and portopulmonary hypertension. Her history of dyspnea since her teenage years suggests the portal vein atresia could be congenital or it had occurred in young childhood. Nevertheless, it is plausible that the portal vein atresia and the resultant portopulmonary hypertension played major roles in the development of the multiple FNH in this case.

In conclusion, we present radiological findings of a rare case of multiple FNH associated with portal vein atresia and portopulmonary hypertension. This case illustrates and supports the pathophysiologic hypotheses that have previously proposed for the concurrent existence of these three abnormalities.

References

1. Wanless IR, Albrecht S, Bilbao J, Frei JV, Heathcote EJ, Roberts EA, et al. Multiple focal nodular hyperplasia of the liver associated with vascular malformations of various organs and neoplasia of the brain: a new syndrome. *Mod Pathol* 1989;2:456-462
2. Wanless IR, Mawdsley C, Adams R. On the pathogenesis of focal nodular hyperplasia of the liver. *Hepatology* 1985;5:1194-1200
3. Portmann B, Stewart S, Higenbottam TW, Clayton PT, Lloyd JK, Williams R. Nodular transformation of the liver associated with portal and pulmonary arterial hypertension. *Gastroenterology* 1993;104:616-621
4. De Gaetano AM, Gui B, Macis G, Manfredi R, Di Stasi C. Congenital absence of the portal vein associated with focal nodular hyperplasia in the liver in an adult woman: Imaging and review of the literature. *Abdom Imaging* 2004;29:455-459
5. Kinjo T, Aoki H, Sunagawa H, Kinjo S, Muto Y. Congenital absence of the portal vein associated with focal nodular hyperplasia of the liver and congenital choledochal cyst: a case report. *J Pediatr Surg* 2001;36:622-625
6. Guariso G, Fiorio S, Altavilla G, Gamba PG, Toffolutti T, Chiesura-Corona M, et al. Congenital absence of the portal vein associated with focal nodular hyperplasia of the liver and cystic dysplasia of the kidney. *Eur J Pediatr* 1998;157:287-290
7. Schmidt S, Saint-Paul MC, Anty R, Bruneton JN, Gugenheim J, Chevallier P. Multiple focal nodular hyperplasia of the liver associated with congenital absence of the portal vein. *Gastroenterol Clin Biol* 2006;30:310-313
8. Kondo F. Benign nodular hepatocellular lesions caused by abnormal hepatic circulation: Etiological analysis and introduction of a new concept. *J Gastroenterol Hepatol* 2001;16:1319-1328
9. Kondo F, Nagao T, Sato T, Tomizawa M, Kondo Y, Matsuzaki O, et al. Etiological analysis of focal nodular hyperplasia of the liver, with emphasis on similar abnormal vasculatures to nodular regenerative hyperplasia and idiopathic portal hypertension. *Pathol Res Pract* 1998;194:487-495
10. Starzl TE, Francavilla A, Halgrimson CG, Francavilla FR, Porter KA, Brown TH, et al. The origin, hormonal nature, and action of hepatotrophic substances in portal venous blood. *Surg Gynecol Obstet* 1973;137:179-199
11. Mandell MS, Groves BM. Pulmonary hypertension in chronic liver disease. *Clin Chest Med* 1996;17:17-33
12. Herve P, Le Pavec J, Sztrymf B, Decante B, Savale L, Sitbon O. Pulmonary vascular abnormality in cirrhosis. *Best Pract Res Clin Gastroenterol* 2007;21:141-159