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TEACHING FILES (GRAND ROUNDS)

HEPATOPULMONARY SYNDROME IS MORE COMMON IN BUDD-CHIARI SYNDROME – MYTH OR TRUTH?

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Clinical Problem

A 6-year-old male suffering from Budd-Chiari syndrome diagnosed at 5 months of age with a block in two hepatic veins and one block in inferior vena cava (IVC) in December 2020, was lost to follow up for the last three years. He presented in July 2025 with fever for 5 days, abdominal distension for 2 days and one episode of haematemesis along with malena. At presentation, he had heart rate 108/min, respiratory rate 30/min, SpO_2 84.1% on room air and blood pressure 79/65 mmHg. Height was 97 cm [z score<-3 SD as per Indian Academy of Pediatrics (IAP)] and weight was 12.5 kg (z score <-3SD as per IAP). There was cyanosis with grade III clubbing with palmar erythema. On abdominal system examination, there was ascites and hepatosplenomegaly. Other systems were normal. Serial laboratory investigations are depicted in Table 1. Upper gastrointestinal (GI) endoscopy showed 4 columns of long length oesophageal varices with red colour sign, and 1 column of small calibre varix without red colour sign. He underwent endoscopic band ligation (EVL) of the oesophageal varices. Bubble contrast echocardiogram was suggestive of hepatopulmonary syndrome (HPS). CT abdomen with triple phase angiography showed atrophy of the medial segments and the left lobe of liver with hypertrophy of the remaining segments. Liver was nodular. There was arterial phase hyperenhancement with retention of contrast in the portovenous and delayed phases. There was non opacification of the hepatic veins and extrinsic compression of the upper hepatic IVC suggestive of chronic Budd-Chiari syndrome with chronic liver parenchymal disease multiple mesenteric and extra-hepatic venous collaterals.

Table 1. Laboratory investigations

	Day of presentation	Day 5 of hospitalisation
Haemoglobin (g/dl)	6.8	7.8
Total White Count (cells/cumm)	5510	6770
Neutrophil %	71.6	67.4
Lymphocyte%	22	23.4
Platelet count (cells/cumm)	72000	35000
Prothrombin time (secs)	14.5	13.7
INR (international normalised ratio)	1.19	1.12
Total Bilirubin (mg/dl)	0.3	0.7
Direct Bilirubin (mg/dl)	0.3	0.4
SGOT/SGPT (U/L)	160/47	56/24
Alkaline Phosphatase (U/L)	-	98
Total protein (g/dl)	4.9	5.3
Albumin (g/dl)	2.9	3.2
pH	7.428	-
Bicarbonate (mEq/l)	16.9	-
Po2 (mmHg)	47.4	-
Sodium (mEq/l)	134	136
Potassium (mEq/l)	4.8	3.7
Ammonium (mmol/L)	79	-
Blood Urea Nitrogen (mg/dl)	26	-
S. Creatinine (mg/dl)	0.32	0.2
CRP (mg/L)	4.8	-

Why is Hepatopulmonary Syndrome a frequent complication of Budd-Chiari Syndrome?

Discussion:

Budd- Chiari syndrome (BCS) is a congestive liver pathology, due to an occlusion in the hepatic outflow tract, at any point, ranging from the hepatic veins to the IVC to the right atrium. The cause of the obstruction can be primary or secondary.[1] In children, BCS is usually primary,[2] i.e. originated due to an endoluminal venous lesion.[1] This leads to static blood flow, which in turn causes chiefly centrilobular hypoxia and eventual ischemia and necrosis, which progresses to fibrosis, chiefly in the perisinusoidal region, causing portal hypertension.[2,3] Depending on this course of events, BCS can present as acute liver failure (20%), fulminant hepatitis (5%) or with sub-acute to chronic manifestations (60%). Common clinical features include fever, abdominal pain, ascites, variceal bleeding and

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encephalopathy.[3]

HPS is a complication of portal hypertension causing dilation of the pulmonary microvasculature leading to abnormal ventilation- perfusion ratio.[4] HPS occurs in 9-20% of children suffering from end-stage-liver-disease[5]. The common cause of HPS is liver cirrhosis with portal hypertension Other causes include extra-hepatic portal vein obstruction (EHPVO),.portal vein thrombosis, regenerative nodular hyperplasia, congenital hepatic fibrosis, and acute liver diseases like ischaemic hepatitis and fulminant hepatitis.[6,7] Three mechanisms are hypothesized in the pathogenesis of HPS. Patients with portal hypertension, with or without cirrhosis, show increased levels of vasodilatory peptides like nitric oxide (NO) and endothelin-1. Endothelin-1 causes vasoconstriction of hepatic sinusoids causing portal hypertension, and activates the NO synthase pathway in pulmonary vessels, leading to vasodilation. Bacterial translocation in cirrhotic patients causes release of inflammatory cytokines like tumour necrosis factor-alpha, and matrix metalloproteinase-9, which contributes. Pulmonary angiogenesis releases factors like vonWillebrand factor, platelet-derived growth factor and placental growth factors, all of which dilates the pulmonary vasculature.[4] HPS presents with pulmonary symptoms (20% cases) like dyspnea, cyanosis and clubbing, or hepatic symptoms (80% cases).[8,9] Devolution to HPS occurs in 10-30% of cases with cirrhosis[6] and 2% with EHPVO.[10] In BCS, 27.6% cases develop HPS.[8] Its diagnostic triad includes confirmation of liver disease, intrapulmonary shunting and alveolar -arterial oxygenation gradient >15 mmHg. The only effective treatment is Liver transplant.[11] HPS is proven to have a higher incidence in BCS, in the Indian population, with many developing without cirrhosis, which implies the possibility of a vascular pathogenesis. Also, in the west, most patients undergo congestion relieving interventional procedures.[8] Most patients here are lost to follow up and they present in a chronic state, which is known to have a higher incidence of HPS.[6,8] Early management of the hepatic congestion could help reduce the incidence of HPS.

Compliance with ethical standards

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Conflict of Interest: None

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