

Pediatric Hepatic Venous Outflow Tract Obstruction: Experience from a Transplant Center

We performed a review of case records of children diagnosed with hepatic venous outflow tract obstruction at our center in last 10 years. Out of 11 cases identified, 6 had variable blocks in the hepatic venous system and 4 had combined hepatic venous and inferior vena cava (IVC) block. One child with paroxysmal nocturnal hemoglobinuria (PNH) had isolated IVC involvement. Angioplasty was attempted in 3 patients; among them 2 had successful outcome. Seven children with advanced liver disease underwent transplantation, which was successful in six. With availability of modalities like interventional radiology and transplantation, the overall prognosis of hepatic venous outflow tract obstruction seems to be good when managed in a well-equipped center.

Keywords: Anticoagulation, Liver transplantation, Management, Outcome.

Hepatic venous outflow tract obstruction (HVOTO), also known as Budd-Chiari syndrome, has been defined as the obstruction to the venous outflow of the liver beginning from small hepatic veins right up to the entrance of the inferior vena cava (IVC) into the right atrium [1]. It is an uncommon disorder in children with a wide variety of predisposing causes. Uncorrected HVOTO progresses to irreversible cirrhosis unless good collateral venous circulation develops spontaneously or the blockage is corrected medically. We present our experience with management of 11 children with HVOTO highlighting the gamut of therapeutic options available for this condition.

A retrospective search of our inpatient records of last ten years was performed to identify patients with HVOTO. A complete history, examination, basic hematological and liver function tests, prothrombotic work up, and results of radiological studies were extracted. Prothrombotic panel including anti-phospholipid antibody (APLA), protein C and S, antithrombin III, factor V leiden mutation, prothrombin gene mutation, *methylene tetrahydrofolate reductase (MTHFR)* gene mutation, serum homocysteine level, lupus anticoagulant, *JAK 2* mutation and paroxysmal nocturnal hemoglobinuria (PNH) profile were done whenever indicated and feasible. Radiological features (morphology, level of block) were noted. Treatment, outcome and follow-up were also recorded.

Case records of 11 children (6 boys) with HVOTO during study period were extracted and reviewed. Mean age of presentation was 10.2 years (range 3-16 years). Duration of symptoms ranged from 8-36 months. Ascites and dilated abdominal veins were the most common findings at presentation in 7 (63.6%) patients followed by hepatosplenomegaly in 6 (54.5%) patients and icterus in 4 (36%). The mean (range) bilirubin, albumin, SGOT, SGPT and PT/INR were 2.63 (1.5,2), 3.4 (2.6,4.1), 49 (33,72), 29 (31,66) and 1.07, respectively.

USG abdomen with Doppler was diagnostic in 8 (89%) cases. CT angiography of liver was performed in all cases, and it was helpful in localizing the block in all the 11 children (**Table I**). Etiological work-up was suggestive of thrombophilia in 4 (36.4%) patients, among them two were positive for APLA and one each was positive for *JAK2* mutation and PNH (**Table I**).

Radiological intervention could be considered only in three patients. It was successful in two, and both had only ascites and hepatomegaly at presentation. It was unsuccessful in one child who had ascites along with other features of chronic liver disease. One patient with PNH, who had IVC block, was managed with low molecular weight heparin (LMWH) followed by warfarin. Percutaneous intervention was not attempted, as he had underlying hemolysis. He was readmitted for portal vein thrombosis (PVT) and again managed by heparin. He recovered over two weeks and was discharged on warfarin. Seven patients were offered and underwent living related liver transplantation for decompensated chronic liver disease (CLD), and they did not undergo angioplasty. One patient died after liver transplantation because of sepsis and related complications. One patient had intraventricular hemorrhage on postoperative day 2. Another patient developed thrombotic thrombocytopenic purpura on day 15 postoperatively and was managed conservatively.

Most common presentation of HVOTO in our study was abdominal distension followed by hepatosplenomegaly and jaundice, which was comparable to an earlier study by Sharma, *et al.* [2]. In another study, hepatomegaly was the most common mode of presentation (84.8%), followed by ascites (82.6%), spider angiomas and dilated veins over abdomen (69.9%) [3].

Etiologies of HVOTO may include thrombotic states, inflammatory conditions, or neoplastic processes of the

TABLE I MANAGEMENT, OUTCOME, POST-OPERATIVE COMPLICATIONS AND FOLLOW-UP OF ELEVEN CHILDREN WITH HVOTO

No.	Age (y)/Sex	Presenting features	Site of obstruction	Treatment and outcomes	Post-operative complications
1	9/M	A, DV, HSM, I	HV+IVC	LRLT, successful	Pleural effusion
2	3/M	A, HSM, I	HV	LRLT, successful	None
3	16/F	A, DV, HSM, I	HV+IVC	LRLT, successful	None
4	4/F	A, DV, HSM, I	HV+IVC	LRLT, successful	IVH, sepsis, hypertension
5	5/M	A, DV	HV	LRLT, successful	Pneumonia
6	5/F	A, DV	HV	LRLT, successful	Ascites
7	16/M	A, DV, HSM	HV	HV stenting, failed	-
8	16/F	A	IVC+HV	IVC+HV stenting	Hematoma at puncture site
9	12/M	A	IVC	Heparin and warfarin	SBP, pneumonia
10	16/F	A	HV	HV stenting, successful	None
11	14/M	HSM, DV, I	HV	Warfarin LRLT, died	Sepsis, ascites

HVOTO: Hepatic venous outflow tract obstruction; A: ascites, DV: dilated veins, HSM: hepatosplenomegaly, I: icterus, LRLT: living related liver transplantation, IVH: intraventricular hemorrhage, HV: hepatic vein, IVC: inferior vena cava, SBP: spontaneous bacterial peritonitis, JAK: Janus kinase, PNH: paroxysmal nocturnal hemoglobinuria.

liver [4]. Three (33.3%) patients in our series had prothrombotic state, which is comparable to the proportion observed by Alam, *et al.* [5], but lower than 75% reported in another pediatric series from India [3].

Varying success rates (20-86%) of anti-coagulation combined with angioplasty have been reported in different series [6-8]. Approximately one-third of patients have short-length stenosis and are candidates for angioplasty. In the remaining 10-20% of patients whom anti-coagulation and intervention radiology procedures fail, liver transplantation remains the only option [6]. Most of the patients in our series had clinical, radiological and biochemical evidence of advanced liver disease. Radiological intervention could successfully be performed in only two patients and both these patients did not have features of advanced liver disease. Reports on the long-term outcomes for orthotopic liver transplantation (OLT) for HVOTO in children are limited to a few sporadic case reports and series [9,10]. With proper case selection, long-term survival rates for pediatric OLT are in excess of 90%.

To conclude, a diagnosis of pediatric HVOTO is often made late. Early referral of such patients to an equipped center has the best possible outcome by giving the opportunity of re-establishing physiological hepatic venous outflow without the need for a surgery. Transplantation in children with advanced stages of liver failure due to HVOTO has helped in improving overall survival.

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reviewed the manuscript for final submission; NG: contributed the data and reviewed the manuscript for final submission. All authors approved the final version of manuscript, and are accountable for all aspects related to the study.

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Teaching Undergraduates Beyond the Classroom: Use of WhatsApp

WhatsApp is a popular platform for social interaction. We used it as an e-learning platform for medical education. We discussed five clinical cases on a WhatsApp group with undergraduates; it increased their knowledge in the subject significantly ($P < 0.001$). Participants accepted it well and perceived that it has improved their problem solving skill and stimulated them for self-study.

Keywords: *E-Learning, Medical education, Social media.*

With the easy availability of smartphones and internet facility, medical students are spending significant time on it. E-learning can be imparted by these smartphones through various mechanisms which have potential to increase collaboration, problem-solving and networking among students. It allows them to share images, data and participate in blogs or video-conferencing [1]. WhatsApp, a social media app is being used frequently for communication and sharing resources in medical field [2]. It can be a useful tool to develop a virtual learning community when meeting face-to-face is not possible [3]. Medical Council of India (MCI) has emphasized on the use of technology in the new competency-based undergraduate curriculum for the Indian medical graduate [4].

This study was done to determine the acceptability and efficacy of WhatsApp as teaching-learning media in promoting problem-solving skills and self-study among medical undergraduates.

We conducted this educational intervention study on ninth semester undergraduate medical students over a period of three months (December 2015 - February 2016) after Institutional Ethics Committee's approval and informed consent from participants. Out of 124 students, 40 students who were already using WhatsApp with their own data pack volunteered to participate, in response to an announcement in the classroom. A WhatsApp group

was created by two participating students including two faculties as administrator. Case scenarios from cardiovascular system (valvular heart disease, arrhythmia, hypertension, heart failure, coronary artery disease) were written, reviewed and revised by co-faculty before being posted on WhatsApp for discussion.

Each case was discussed over 5-7 days by posting a case scenario followed by some trigger questions (**Box 1**) for making and analyzing differential diagnosis, interpretation of relevant investigations and management plan with reasoning. Laboratory reports, X-rays and ECGs were shared maintaining anonymity of patients. Students were advised to go through books and other resources, if needed. They responded to questions with reasoning, sometimes backed by relevant resources and/or raised their doubts. Right answers were appreciated; cues, feedback and correct answers were provided to address doubts and wrong answers. Discussion was done during evening and night time on working days and throughout the day on holidays. 'Active participation' was considered if participants responded to questions or asked queries on WhatsApp. Feedback was taken using a structured paper proforma, filled individually by each

Box 1 EXAMPLES OF QUESTIONS ASKED TO PROMOTE REASONING / PROBLEM SOLVING SKILLS*

- What are the possible differential diagnoses?
- Give points in favour and against each diagnosis at this point of time.
- Out of all differential diagnoses, which one is most likely and why?
- What more information will you like to know about history and examination to reach the final diagnosis?
- What investigation will you like to order at this point of time? And why?
- Based on this new information, what could be the cause of deterioration in this patient? What do you think about this new development in the case?

In addition, relevant questions were asked to elicit the 'Why' and 'How' during the discussion as per the need.