CLINICAL STUDY

Endovascular Management of Budd-Chiari Syndrome with Inferior Vena Cava Thrombosis: A 14-Year Single-Center Retrospective Report of 55 Patients

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ABSTRACT

Purpose: To evaluate safety and efficacy of balloon dilation and stent placement combined with thrombus aspiration and thrombolysis to treat patients with Budd-Chiari syndrome with inferior vena cava (IVC) thrombosis.

Materials and Methods: Charts from 55 consecutive patients with primary BCS and IVC thrombosis treated between April 2000 and August 2014 were retrospectively analyzed. Transcatheter aspiration and percutaneous recanalization were attempted in all patients, and stents were placed if balloon dilation was successful. Catheter-directed thrombolysis was performed when evident clot burden was present after recanalization.

Results: Technically successful IVC recanalization was achieved in 53 of 55 patients (96.4%). Technical failures in 2 patients were due to long segment of IVC obstruction. A stent was placed in 47 of 53 patients (88.7%). Thrombus was successfully aspirated in 23 patients, and thrombolytic treatment was administered to 13 patients. Median follow-up was 58 months (range, 8–180 mo). No symptomatic pulmonary embolism occurred. Reocclusion occurred in 8 patients, and 6 of these patients (75%) underwent repeat recanalization by balloon dilation with or without stents. Cumulative 1-, 5-, and 10-year primary patency rates were 94%, 89%, and 66%. Alanine transaminase and alkaline phosphatase levels were independent risk factors for reocclusion. Cumulative 1-, 5-, and 10-year survival rates were 90%, 86%, and 86%. Child-Pugh score and reocclusion were independent predictors of survival.

Conclusions: Percutaneous vena caval balloon dilation and stent placement with thrombus aspiration and thrombolytic therapy is safe and effective for treatment of patients with BCS and IVC thrombosis.

ABBREVIATIONS

BCS = Budd-Chiari syndrome, CI = confidence interval, HR = hazard ratio, HV = hepatic vein, IVC = inferior vena cava, PE = pulmonary embolism, TIPS = transjugular intrahepatic portosystemic shunt

Budd-Chiari syndrome (BCS) is an uncommon but life-threatening condition characterized by obstruction of the hepatic venous outflow tract from the small hepatic veins (HVs) to the confluence of the inferior vena cava (IVC) and the right atrium (1). In contrast to patients with BCS in Western countries, who mainly experience involvement of HVs, Asian patients with BCS usually experience IVC occlusion with or without HV involvement (2). An obstructed hepatic IVC can lead to stagnant, reversed, or turbulent blood flow at the proximal end of the occluded site, which makes the IVC more susceptible to thrombus formation. The prevalence of BCS complicated by IVC thrombosis has been reported to be 5%–20% (3). For these patients, the main clinical concern is prevention of a pulmonary embolism (PE) from IVC thrombus residue drifting into the pulmonary circulation after IVC recanalization (4,5). Because of this concern, thrombotic occlusion of

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the IVC was previously an absolute contraindication to percutaneous balloon angioplasty alone in acute thrombosis (6). Various treatment strategies have been proposed as solutions, such as anticoagulation with warfarin (3,7,8), thrombus aspiration (9), agitation thrombolysis (10), thrombolysis following a first dilation with a small balloon (11–13), stent placement (14,15), and placement of an IVC filter (12,16,17). In our center, a detailed clinical history and thorough evaluation with imaging determine the timing of the IVC thrombosis. Based on this assessment, we devised and adopted a treatment strategy in which we dilated the obstructed vein using balloons immediately after thrombus aspiration in patients with BCS complicated by IVC thrombosis. Transjugular intrahepatic portosystemic shunt (TIPS) placement was performed if patients did not respond to angioplasty in line with the guidelines (18,19). The purpose of this study was to assess the safety and efficacy of our endovascular treatment strategies consisting of percutaneous thrombus aspiration, catheter-directed thrombolysis, balloon dilation, and stent placement in 55 patients with BCS and concurrent IVC thrombosis.

MATERIALS AND METHODS

We retrospectively reviewed the charts of 406 consecutive patients with BCS who were admitted to our center for digestive diseases between April 2000 and August 2014. Inclusion criteria were (*i*) a diagnosis of primary BCS; (*ii*) symptoms and signs of IVC obstruction on presentation; and (*iii*) IVC thrombosis diagnosed by color Doppler ultrasound, computed tomography (CT), magnetic resonance imaging, or venacavography. All patients had at least 1 of the following clinical manifestations: abdominal pain, abdominal distention, ascites, variceal bleeding, hepatic encephalopathy, lower extremity edema, or jaundice. Patient characteristics are summarized in **Table 1**. The study protocol was approved by the ethics committee of our hospital. A flow chart of this study is shown in **Figure 1**.

Table 1. Baseline Characteristics of 53 Patients in Whom Balloon Dilation Was Technically Successful

Variable	Value
Sex	
M/F	39/14
Clinical manifestation	
Abdominal pain	7
Abdominal distention	37
Ascites	
Grade 1/2/3	15/7/4
Variceal bleeding	7
Hepatic encephalopathy	5
Lower extremity edema	42
Lower extremity pigmentation	19
Site of outflow obstruction	
IVC	17
Combined HVs and IVC	36
Membranous obstruction/segmental obstruction	19/34
Age of IVC thrombus	
Acute	3
Subacute	20
Chronic	30
Laboratory tests	
Platelet count ($\times 10^9$/L)	101 (31–201)
Bilirubin (μmol/L)	37.3 (8.5–174.2)
Albumin (g/L)	35.9 (24.3–49.6)
ALT (× ULN)	1.00 (0.1–14.18)
ALP (× ULN)	0.92 (0.34–2.41)
Creatinine (μmol/L)	81.8 (54–164)
Blood urea nitrogen (mmol/L)	5.4 (1.5–18.5)
Prothrombin time (s)	16.3 (12.3–24.8)
International normalized ratio	1.4 (1.0–2.7)
Clinical prognostic indexes	
Child-Pugh score	7 (5–12)
A/B/C	28/18/7
Original Clichy score	5.21 (3.25–7.80)
Rotterdam score	0.80 (0.03–2.77)

Note–Data are medians, with ranges in parentheses.
ALT = alanine aminotransferase; ALP = alkaline phosphatase; F = female; HV = hepatic vein; IVC = inferior vena cava; M = male; ULN = upper limit of normal.

Diagnosis and Definitions

BCS was diagnosed with color Doppler ultrasound, CT, magnetic resonance imaging, or angiography. Primary BCS was defined as hepatic venous outflow obstruction originating from an endoluminal venous lesion. Patients with hepatic venous outflow obstruction originating from a lesion outside the venous system (eg, tumor, abscess, cysts), known as secondary BCS, were excluded. BCS was classified according to the location of obstruction: (*i*) IVC type, which manifests as obstruction of the IVC with at least 1 main patent HV; (*ii*) combined HV/IVC type, which manifests as obstruction of both the IVC and the 3 main HVs; or (*iii*) HV type, which manifests as obstruction of the 3 main HVs (20). In our study, only patients with IVC and combined HV/IVC types were included. BCS was subdivided according to the length of IVC obstruction into either membranous obstruction or segmental occlusion. If the occlusion was $<$ 1 cm in length, it was considered a membranous occlusion; otherwise, it was a segmental occlusion. Thrombus was classified as acute, subacute, or chronic, which was determined by considering (*i*) medical history, (*ii*) imaging examination, and (*iii*) the result of thrombus aspiration. An acute thrombus contained mainly a fresh, dark red, soft blood clot that could be easily aspirated. A chronic thrombus was often an old mural, white thrombus that could not easily be thoroughly aspirated.

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