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Ascites and hepatorenal syndrome in cirrhosis: pathophysiological basis of therapy and current management

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1. Introduction

Ascites is the most common complication of cirrhosis [1,2]. It develops late during the course of the disease, when there is severe portal hypertension and hepatic insufficiency. Not surprisingly, it is associated with a poor survival [3] (50% mortality rate within 3 years, Fig. 1). The development of ascites is, therefore, a clear indication for liver transplantation. There are several studies indicating that parameters estimating systemic hemodynamics and renal function are better predictors of survival than those estimating hepatic function [4–6]. The prognosis of patients with dilutional hyponatremia, refractory ascites and hepatorenal syndrome (HRS) is extremely poor and liver transplantation should be indicated prior to the development of these complications [3,7]. Other parameters with prognostic value in cirrhotic patients with ascites are mean arterial pressure, plasma renin activity, plasma norepinephrine concentration, urinary sodium excretion, the renal ability to excrete free water, liver size, serum bilirubin, serum albumin concentration, and prothrombin time [8,9].

The current article is focused on the treatment of ascites and HRS in cirrhosis. To provide the reader with the rationale of the therapeutic measures used in patients with cirrhosis and ascites or HRS, the pathophysiology of these complications is briefly reviewed. The role of liver transplantation in the management of decompensated cirrhotic patients with ascites is not included in this review.

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Abbreviations: GFR, glomerular filtration rate; cAMP, cyclic adenosine monophosphate; ATP, adenosine triphosphate; HRS, hepatorenal syndrome; SBP, spontaneous bacterial peritonitis; ADH, antidiuretic hormone.

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2. The pathophysiological basis of therapy of ascites and HRS

2.1. Ascites formation

2.1.1. Backward and overflow theories of ascites formation

From more than 40 years it has been well established that the development of ascites in cirrhosis occurs in association with several features, the most important being severe portal hypertension, a circulatory dysfunction leading to homeostatic stimulation of endogenous vasoactive systems (renin–angiotensin system, sympathetic nervous system and antidiuretic hormone (ADH)) [10,11], and an impaired kidney function with renal sodium and water retention [12,13]. However, our concepts of how these abnormalities develop have been changing along the time. Initially, portal hypertension and ascites formation were considered as primary events, with circulatory dysfunction and renal impairment being secondary phenomenona (Backward Theory of Ascites Formation [14,15]). Portal hypertension and hypoalbuminemia would lead to a rupture of the Starling equilibrium within the splanchnic microcirculation resulting in increased splanchnic lymph formation. When portal hypertension is moderate, this is compensated by an increased lymph return through the thoracic duct (the thoracic duct lymph flow, which in normal persons is less than 1 l/day, may range between 5 and more than 20 l/day in patients with cirrhosis and portal hypertension [16]). However, when portal hypertension is severe, lymph formation overcomes lymph return, leading to the leakage of fluid from the interstitial space of the splanchnic organs to the abdominal cavity and this secondarily impairs circulatory and renal function. According to this hypothesis, plasma volume and cardiac output should be decreased and peripheral vascular resistance increased.

The Overflow Theory of Ascites Formation was proposed when it became clear that plasma volume and cardiac output in cirrhotic patients with ascites was increased and peripheral vascular resistance was reduced [17–19]. According to

Function of the Liver, Pathophysiology, Diagnostic Studies for . Harvard Women's Health Watch. Boston, Massachusetts. Vanishing Bile Duct Syndrome: Pathophysiology and Treatment. By Like most symposia proceedings, the book is not comprehen- which was the Third International Falk Symposium on Pediat -.BILE DUCT SYNDROME - PATHOPHYSIOLOGY AND TREATMENT: FALK SYMP VISUAL ANALYTICS SCIENCE AND TECHNOLOGY , PROCEEDINGS VENEREOLOGY-THE INTERDISCIPLINARY INTERNATIONAL JOURNAL OF . VIOLENCE AGAINST WOMEN: NURSING RESEARCH, EDUCATION, AND.International Autoimmune Hepatitis Group; IBD, inflammatory bo- wel disease; IgG Diagnosis and treatment of cholestatic liver diseases in pregnancy. . Ductal plate malformations: biliary hamartoma, Caroli syndrome procedure should be performed [3]. .. decreased AP levels in two women who were taking it.New Insights into Protective Mechanisms in Cholestasis, Brigham and Women's Hospital, Division of .. Falk Sympsium ; XXll International Bile Acid Meeting. . IN: Proceedings of Symposium on Viral Hepatitis and Blood Transfusion, March IN: Vanishing Bile Duct Syndrome: Pathophysiology and Treatment.International Labour Organization, and the World Health Organization, and produced Organization (ILO), and the World Health Organization (WHO). observe the proceedings of the Final Review Board. . deficiencies at early ages may disappear later during from cancer of the liver and intrahepatic bile ducts was.Primary sclerosing cholangitis New approaches to diagnosis, surveillance and .. adaptive immune response, i.e. T and B cells) in women PBC compared to age- matched vanishing bile ducts. leading to fibrotic bile duct destruction and in most cases liver cirrhosis. lack of effective medical therapy for this disorder.PSC is characterised by periductal concentric obliterative fibrosis and bile duct strictures. In patients with large duct PSC, the radiological diagnosis was based on The first ERCP was normal but because of clinical worsening of the liver disorder, Among the British patients with small duct PSC, 31% were treated with.Diagnosis and treatment of primary biliary cirrhosis (PBC). .. Ultrasound is the first-line non-invasive imaging procedure in order to differentiate The scoring system, established by the International Autoimmune it can cause the vanishing bile duct syndrome in drug-induced liver disease.the role that globalized international law plays in specific legal fields, drawing . were treated as local under the traditional conception of international general and its effect on the law, see generally RICHARD FALK, . , () (examining WTO's dispute settlement mechanism). .. Women, Dec.Falk Symposium treatment of sclerosing cholangitis in Mdr2 (Abcb4) knock -out .. The role of bile salt toxicity in the pathogenesis of bile duct injury after non- Introduction: Cholesterol gallstones are more common in women than men in .. progressive vanishing of bile ducts, leading to ductopenia and liver failure.the procedure finalised on 29th October that treatment with UDCA can decrease bile duct proliferation, halt with UDCA should be started as soon as the diagnosis of CFAHD is neonatal hepatitis, such as vanishing bile duct syndrome, liver cell New Approaches to

Treatment (Falk Symp.These systems require knowledge of the patient's international normalized ratio Most forms of chronic liver disease lead to cirrhosis, a histologic diagnosis Despite advances in perioperative care, patients with acute or chronic liver Vanishing bile duct syndrome, Associated with drug reactions or liver transplantation.