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# Unilobar tapering cirrhosis in a patient with Caroli syndrome associated with an abnormal common bile duct

## Tek lobu tutan siroz ve beraberinde anormal koledoğu olan Caroli sendromu hastası

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*Caroli syndrome is a rare condition and is composed of congenital cystic dilatation of the biliary system and congenital hepatic fibrosis. Although many associated conditions are defined and hypothesized to occur concomitantly, due to the rarity of this syndrome, none has proven to be an essential component of this syndrome. In order to investigate a patient presenting with a cholestatic clinical picture, ultrasound, endoscopic retrograde cholangiopancreatography, abdominal computed tomography, liver biopsy, splenoportal venous angiography, and all available liver tests were performed. Upon typical findings, a diagnosis of Caroli syndrome was made and an orthotopic liver transplantation was performed. Investigation of the patient demonstrated multiple intracystic stones mimicking hemangiomatosis in the ultrasound; severe irregularity and narrowing in the main bile duct mimicking sclerosing cholangitis in the endoscopic retrograde cholangiopancreatography; partial portal vein thrombosis with irregularity in the portography; and a unilobar cirrhosis of the left liver lobe while the right lobe demonstrated only congenital hepatic fibrosis in the explanted liver. Caroli syndrome may be associated with main bile duct and portal vein abnormalities. Although the syndrome can be monolobar in nature, a cirrhotic left lobe sparing the right lobe, partially affected by the cirrhotic process, has never been defined. Here, we report a case of Caroli syndrome who had liver transplantation, with very rare and interesting findings of the explanted liver, such as tapering cirrhosis from the left lobe to the right lobe and countless stones in biliary cysts mimicking hemangiomas.*

**Key words**: Caroli syndrome, cirrhosis, portal vein thrombosis, liver cysts

*Caroli sendromu konjenital hepatik fibrozis ve biliyer sistemin doğumsal kistik dilatasyonundan oluşan nadir bir hastalıktır. Pekçok birlikte hastalık tanımlanmış ve beraberlikleri öne sürülmüş olsa bile, hastalığın nadir olmasından ötürü hiçbirisinin bu sendromun esansiyel bir komponenti olduğu ispat edilememiştir. Kolestatik bir tablo ile başvurmuş bir hastada ultrasonografi, endoskopik retrograt kolanjiyopankreatografi, abdomen bilgisayarlı tomografi, karaciğer biyopsisi, splenoportal venöz anjiografi gibi tetkikler ve tüm mevcut karaciğer fonksiyon testleri çalışıldı. Caroli sendromu'nun tipik özelliklerinin saptanması üzerine, ortotopik karaciğer transplantasyonu yapıldı. Ultrasonografide hemanjiomu düşündüren multipl intrakistik taşlar, endoskopik retrograt kolanjiyopankreatografide primer sklerozan kolanjitte olduğu gibi ana safra kanalında ciddi darlık ve irregülarite, portografide parsiyel ven trombozu ve irregülarite, çıkarılan karaciğer sol lobunda ise tek lobu tutan siroz ve sağ lobda hepatik fibrozis bulguları tespit edildi. Caroli sendromu koledok ve portal ven anormallikleri ile beraberlik gösterebilir. Sendrom, tek lobu tutmakla beraber, sadece sol tarafı tutan ve sağ lobu kısmen etkilemeyen bir sirotik durum şimdiye kadar tanımlanmadı. Biz bu vaka sunumu ile, transplantasyon yapılmış bir Caroli sendromu hastasında, eksplante karaciğerde izlenen çok nadir ve ilginç bulgular olan sol lobdan sağ loba gittikçe azalan bir sirotik gelişmeyi ve biliyer kistlerde hemanjiomu düşündüren çok sayıda taşları olan bir olguyu sunmayı amaçladık.*

**Anahtar kelimeler**: Caroli sendromu, siroz, portal ven trombozu, karaciğer kistleri

## INTRODUCTION

Caroli syndrome (CS) is characterized by a combination of dilatation of the biliary system and congenital hepatic fibrosis. There is an abnormal ductal plate formation in which the remodeling process is arrested along with inflammatory destruction of the biliary ducts. The liver parenchyma is also affected by congenital hepatic fibrosis, in contrast with Caroli's disease, in which the parenchyma is normal (1).

The prevalence of CS is very low and follows the autosomal recessive type of inheritance. Siblings may become affected at the same time (2). The presentation of CS is protean and depends on severity of the liver involvement parallel to progres-

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sion of decompensation. The liver involvement may be monolobar depending on the timing of the arrest of the ductal plate remodeling. Monolobar Caroli's disease is defined in the literature (3, 4). Besides the possible renal complications, obstruction with repeated infections of the biliary system and sepsis-related complications result in morbidity and mortality. Although many complications have been reported, this report describes a CS patient with a well-established left lobe cirrhosis, probably resulting from severe obstruction of the biliary tree, compared to the right lobe, a preserved right lobe only partially affected in the explanted liver, portal vein thrombosis, and common bile duct abnormality in imaging modalities.

## CASE REPORT

A 33-year-old female patient was admitted with abdominal discomfort and icterus. The examination revealed a large palpable spleen without ascites. The hepatitis markers and liver autoantibodies were negative, and screenings for other causes of liver diseases such as Wilson's disease and hemochromatosis were also normal. The upper endoscopy revealed varices. To evaluate the presenting cholestasis and portal hypertension, Doppler ultrasound (US) of the abdomen and computed tomography (CT) portography were performed, which demonstrated a partially thrombosed right and main portal veins and portal hypertension characterized by hepatofugal collaterals located in the epigastric area along with massive splenomegaly (Figure 1). US revealed cavernous transformation at the hilum. The CT showed hemangioma-like lesions in the right lobe containing structures in the density of stones and some cystic dilatations in both lobes (Figure 2). The common bile duct was not visible with these techniques. To evaluate the common bile duct and cystic dilations, an endoscopic retrograde cholangiopancreatography (ERCP) was performed (Figure 3), which showed multiple cystic dilatations in both lobes communicating with each other and the common bile duct. There were multiple stones in the cysts corresponding to the hemangioma-like lesions on the US. There was total irregularity and narrowing of the common bile duct, which we identified as a "pseudocholangiocarcinoma sign" (5, 6). A liver biopsy was performed, which revealed congenital hepatic fibrosis, confirming the diagnosis of CS. Upon findings of decreased blood flow in the portal system and the pseudocholangiocarcinoma sign, an arterial portography was performed, which failed to visualize the portal system. The venous splenoportography showed that the main portal vein was partially obstructed along with the right main portal vein.

During the two-year follow-up period, the patient was hospitalized at different times due to infections of the biliary tree and developed ascites, indicating an impending liver failure. Because of the narrowed common bile duct preventing the drainage of the cystic lesions containing multiple stones and signs of liver failure, we decided to perform a liver transplantation.

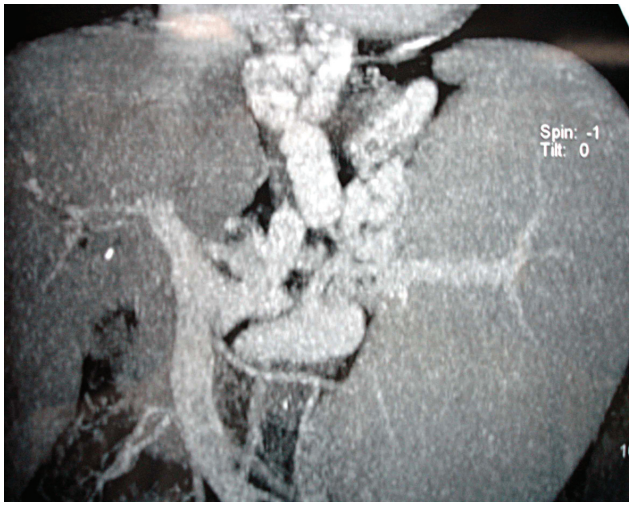


**Figure 1.** CT portography showing massive splenomegaly with partially thrombosed right and main portal veins and collaterals clearly indicating portal hypertension.

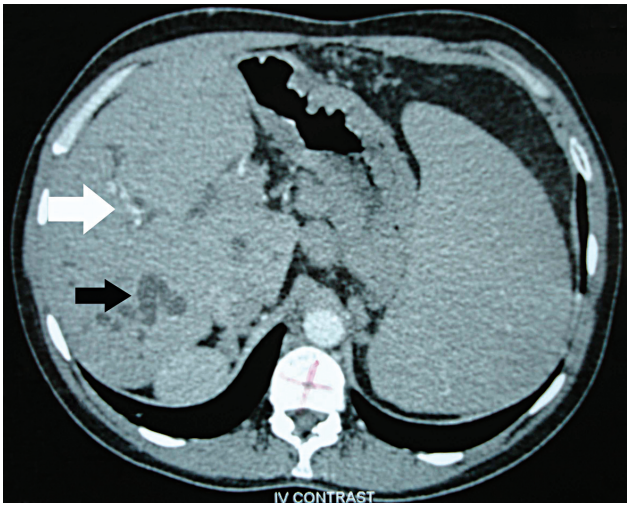


**Figure 2.** Cystic dilatations (black arrow) and bile stones within the cystic strucures (white arrow).

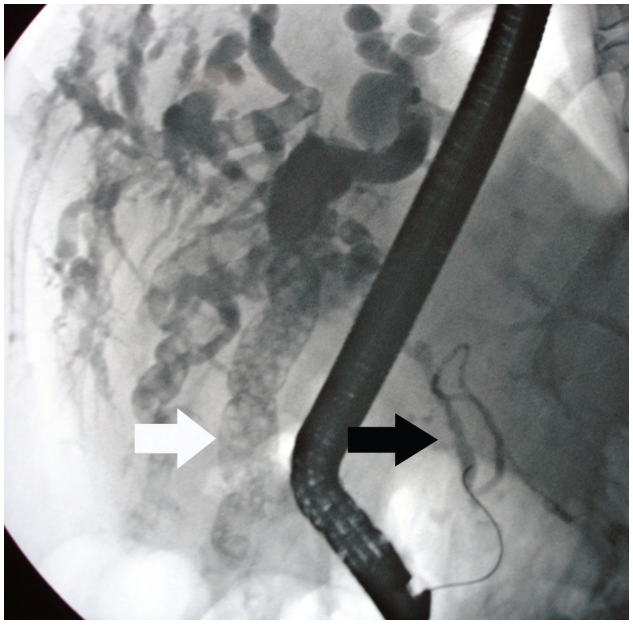

**Figure 3.** ERCP demonstrates irregular narrowed and undulated common bile duct (black arrow). Multiple cystic dilatations, some of which contained countless stones (white arrow), are seen.

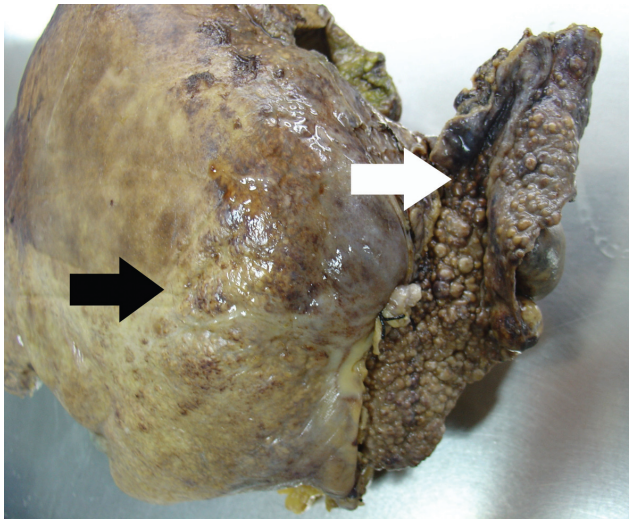

**Figure 4.** The explanted liver (formalin fixed) shows clearly atrophic and cirrhotic left lobe (white arrow) and relatively normal-appearing right lobe (black arrow).

Grossly, the explanted liver demonstrated that the left lobe was atrophic and cirrhotic with visible nodules, while the right lobe appeared non-cirrhotic macroscopically with a clear border separating the two lobes (Figure 4). The cut surface showed that the cysts were filled with dense biliary sludge and multiple stones of various sizes (Figure 5A, 5B). The striking findings were the dilated biliary system with cystic dilatations of the right lobe compared to left lobe composed of micronodular cirrhotic nodules. Examination of both lobes did not reveal any sign of malignancy, including the irregular main bile duct. The microscopy of the left lobe showed multiple regenerative cirrhotic nodules divided by fibrous bands (Figure 6), while the right lobe showed congenital hepatic fibrosis with the exception of the transition zone between the two lobes (Figure 7). There was mild to moderate deposition of collagenous material and increased reticulin formation and biliary ductule proliferation with pericanalicular fibrosis. The right portal system revealed formation of microcavernous vessel transformation possibly due to recanalization of micro-thrombi formed before transplantation. Similarly, the left portal system showed evidence of thrombosis. There was an intimal increase in the main portal venous system due to deposition of collagenous material. The examination of

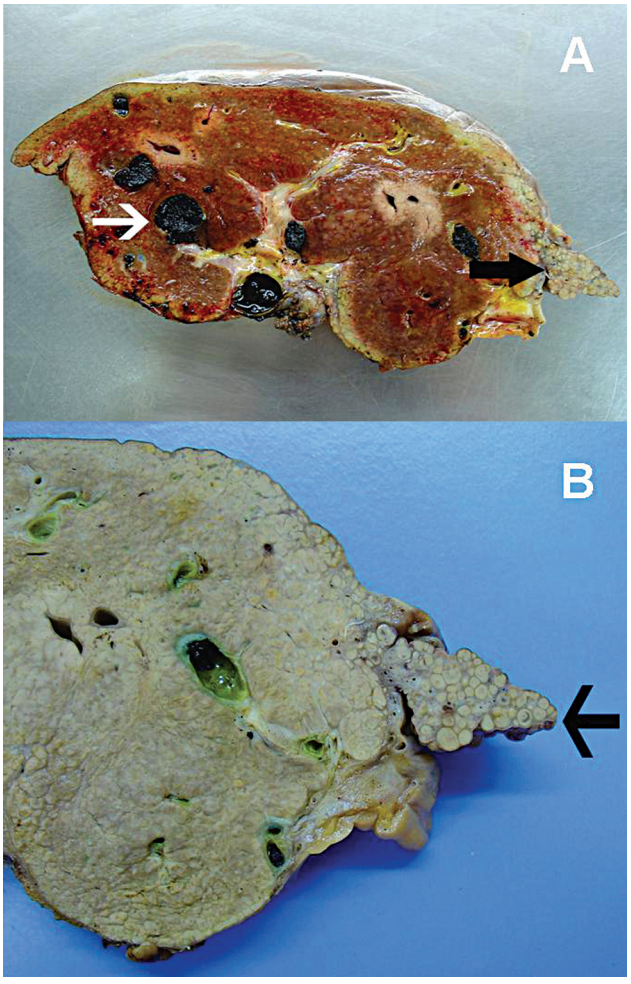


**Figure 5.** Freshly explanted **(A)** and formalin-fixed **(B)** cut surface of the liver showing multiple cysts and cirrhotic nodules in the left lobe.

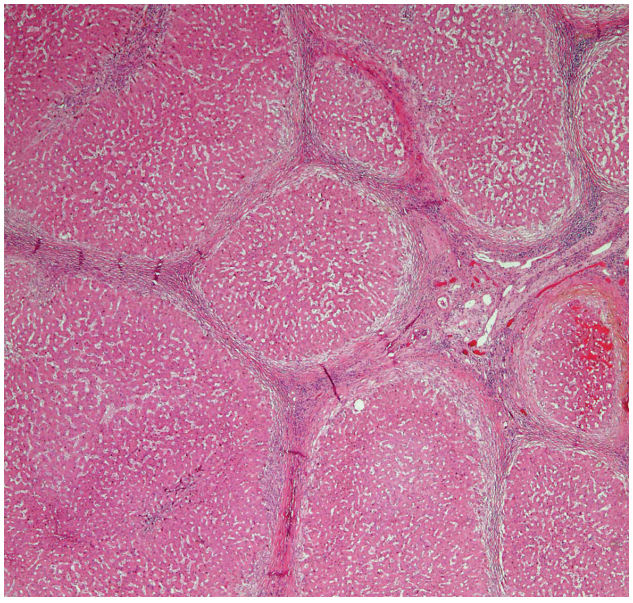

**Figure 6.** Histology of the left lobe: multiple regenerative cirrhotic nodules divided by fibrous bands.

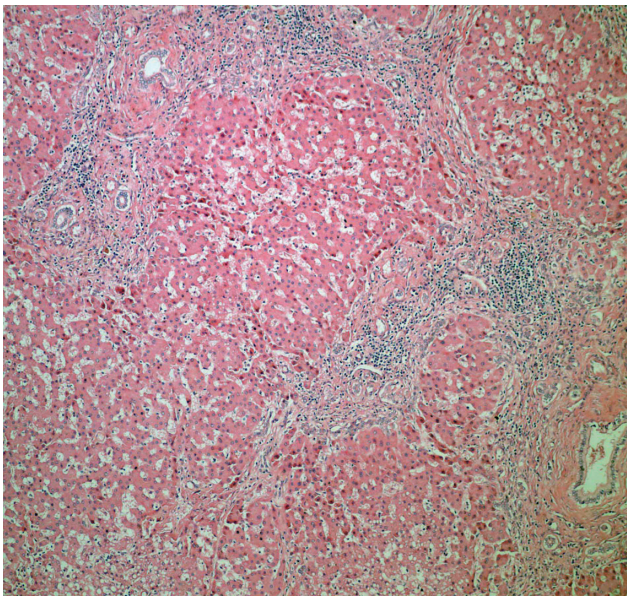

**Figure 7.** Histology of the right lobe: consistent with congenital hepatic fibrosis characterized by bile duct proliferation, dilatation and fibrosis, with the exception of the transition zone between the two lobes.

the irregular and fibrotic main bile ducts was not diagnostic to conclude a specific diagnosis as the only finding was increased collagen in the walls. There were no stones in the common bile duct that could have resulted in bile duct dilatation.

## DISCUSSION

Cirrhosis is a potential complication of both Caroli's disease and CS resulting from chronic biliary stasis and repeated infections in the biliary system. However, the period required for chronic cholestasis to result in cirrhosis is so long that most of the patients suffer from infectious complications and the natural course usually ends by death due to biliary sepsis or liver transplantation. In a rare case presenting with a full-blown cirrhosis due to CS, the pattern of involvement is unquestionably bilobar. Although not defined in the literature, the exception may be a monolobar involvement of CS to result in a monolobar cirrhosis. Liver cirrhosis is a generalized condition affecting the liver entirely. In contrast, this case shows that one lobe was totally cirrhotic while the other was not totally affected from the cirrhotic process. There was a transition segment between the lobes with a precirrhotic condition. The presented data proves that whatever the reason, this is not a uniform condition affecting the liver homogeneously and resulted in such a tapering cirrhosis.

There are five types of congenital biliary cysts according to Todani classification (7), in which Caroli's disease and CS are classified under type V cysts, and it is well known that the common bile duct is normal in CS. The duct becomes affected later in life due to repeated infections, and findings of distortion, irregularity and narrowing are sequelae of untreated infections, impacted stones and possible cholangiocellular carcinoma. The abnormality of the common bile duct with the absence of repeated infections in the patient's history and clinical presentation of the patient are very interesting.

There are three questions to answer: Firstly, why is cirrhosis unilobar? The screening of all other causes of cirrhosis was negative. The possible explanations are: a) the biliary drainage of the left lobe was probably impaired more than that of the right lobe, leading to chronic cholestasis resulting in secondary biliary cirrhosis, b) blood supply to this lobe was impaired due to portal thrombosis, leading to chronic ischemia and atrophy, and c) all of these conditions played a role in the process resulting in cirrhosis. This interesting case showed that the cirrhosis tapers from the left lobe towards the right, changing both in intensity and histological findings.

Secondly, why is the common bile duct narrow and irregular? The possible explanations for this are:

a) compression of the thrombosed portal vein (portal vein compression can be a congenital abnormality that is believed to occur with congenital hepatic fibrosis), b) recurrent silent cholangitis attacks might have resulted in a deformed common bile duct, and c) fibrotic and narrowed bile duct might be an unknown but rare component of congenital hepatic fibrosis in which other organ abnormalities are known. However, the explanted liver examination showed no stones in the common bile duct without inflammation to be compatible with chronic cholangitis. This result might exclude chronic recurrent cholangitis due to stones already present in the cystic dilatations.

Thirdly, why did stones resemble hemangiomas on the US? Other hemangioma-like lesions in the liver include focal nodular hyperplasia, adenomas, primary or metastatic carcinoma, lipoma, and fatty changes. Since CS is related with US findings of intracystic stones, which have typical echoic shadows in cystic lesions, this interesting finding can be attributed to the dense biliary sludge inside the cysts. The echogenic density of the dense material should be between the biliary stone and soft tissue.

We can conclude that decreased portal venous blood flow together with chronic cholestasis due to the narrowed common bile duct may result in monolobar cirrhosis tapering towards one lobe. The common bile duct and portal abnormalities may be counterparts of this rare liver condition. The stones and dense biliary sludge in the cysts can resemble and mimic hemangiomatosis of the liver.

Although the major complications of CS are infections or related drainage problems that result in need for transplantation or endoscopic treatments, this type of cirrhosis in a CS patient has never been defined previously.

The patient is currently doing well. With this case report, we tried to explain unilobar liver cirrhosis due to the left lobe being affected by more extensive biliary drainage abnormalities and portal vein thrombosis, when compared to the right lobe. We believe that over time, the right lobe would have also developed well-established liver cirrhosis if liver transplantation had not been performed.

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