

# The Journal of Cardiovascular Surgery

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OFFICIAL JOURNAL OF THE INTERNATIONAL CARDIOVASCULAR SOCIETY

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JAN NIELUBOWICZ, WALDEMAR OLSZEWSKI

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## A method for production of experimental portal hypertension and ascites

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E D I Z I O N I M I N E R V A M E D I C A

A major difficulty in experimental studies of portal hypertension and ascites has been the lack of a suitable method for producing hepatic venous outflow obstruction without producing alterations of pressure and blood flow in the inferior vena cava. It was found in our previous studies on biliary strictures that bile stasis after partial constriction of the common bile duct is often accompanied by portal hypertension and ascites. The present study was directed at developing a consistent technique of producing portal hypertension and ascites in dogs, by constricting the common bile duct.

#### METHODS

In 15 dogs a plastic ring of 2 or 3 millimeters internal diameter was applied around the common bile duct. The constriction produced was 50 or 70 per cent of the area of cross section of the duct. After the operation an evaluation of the increase in abdominal circumference and of presence of distended veins in the umbilical region was made. The serum bilirubin, GOT, and alkaline phosphatase was estimated. Laparotomy was performed when there was evidence of ascites. The portal and biliary pressures were measured, venogram or splenogram taken, and observation of any intra-abdominal abnormality made. Intra-abdominal fluid, hepatic and intestinal lymph were chemically investigated.

Read at VI Congress of the International Cardiovascular Society, Rome, Sept. 18-21, 1963.

#### RESULTS

Portal hypertension and ascites developed in 12 of the 15 dogs (80%) in 6 to 31 weeks after the common bile duct had been constricted. Grossly there were many dilated veins in the umbilical region. The veins in omentum and mesentery were, multiple tortuous communicating veins between the mesenteric, splenic and left renal vein as well as the inferior vena cava were observed. The lymphatic vessels in the mesentery, liver hilum and on the anterior aspect of the spine were grossly dilated. The liver appeared to be macroscopically normal. Although the constricted segment of the common bile duct was usually patent the extrahepatic bile ducts and the gallbladder were enormously dilated. The portal vein was patent in all cases and there was no compression by the dilated common bile duct. No splenic abnormality was seen. Microscopical examination disclosed some periportal fibrosis, proliferation of bile ducts and dilatation of veins in the portal areas.

The average peak of portal pressure was 22,6 cm of water with a wide range of 15 to 41 cm of water as compared with 11,5 cm of water in the control group. The average pressure in the inferior vena cava was 7,5 cm of water giving an average gradient of 15,1 cm of water between the portal vein and the inferior vena cava. The average pressure in the common bile duct was



Fig. 1.—Photomicrograph of the portal area with dilated portal vein.

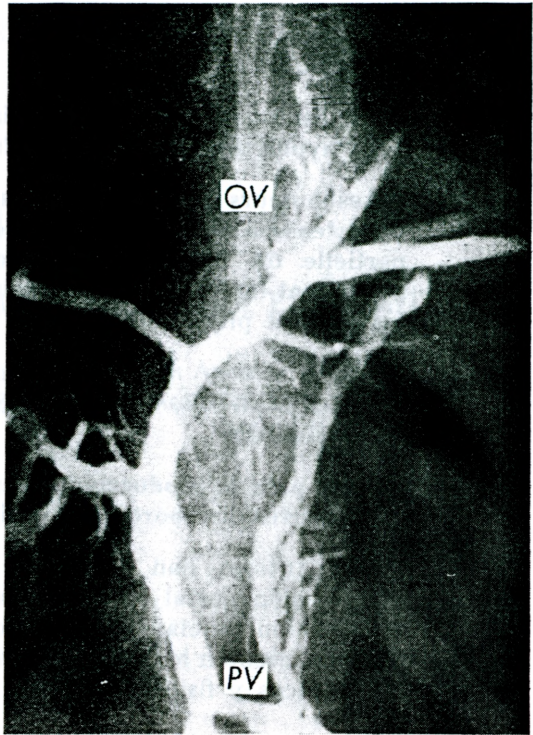


Fig. 3.—Portogram showing dilated intrahepatic tributaries (PV) of the portal vein and esophageal varices (OV).

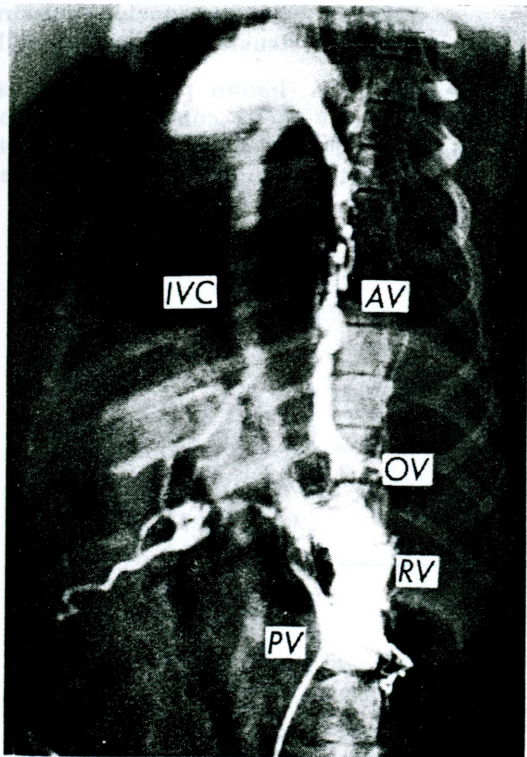


Fig. 2.—Portogram showing collateral channels. A) Portal vein (PV) to retroperitoneal veins (RV) to inferior vena cava (IVC). B) Splenic vein to gastric tributaries to esophageal veins (OV) to azygos vein (AV).

15,1 cm of water with a range of 7 to 21 cm of water.

Ascites was seen in 11 of 15 dogs. The intra-abdominal fluid was clear pale-yellow in all cases. Its average volume was

750 cc, the average specific gravity was 1010, and the average protein content 0.86 G/100 cc. The average protein content in intestinal lymph reached 0.89 G/100 cc. Hepatic lymph protein amounted to 4.37 G/100 cc.

Venography disclosed extensive portal-systemic collateral channels between: 1) the splenic vein and the left renal vein, 2) the superior mesenteric vein and the inferior vena cava, 3) the esophageal veins and the azygos vein and the superior vena cava.

CONCLUSIONS AND SUMMARY

This study demonstrates that partial constriction of the common bile duct may be used as a method for production of the persistent portal hypertension and ascites.

**J. NIELUBOWICZ, W. OLSZEWSKI, S. SZY-  
FELBEJN**

**Méthode de production expérimentale de  
l'hypertension portale et de l'ascite.**

Les auteurs ont produit chez les chiens hypertension et ascite par une constriction partielle du conduit biliaire commun et présentent les résultats histologiques, radiologiques et physiologiques.

**J. NIELUBOWICZ, W. OLSZEWSKI, S. SZY-  
FELBEJN**

**Método para la producción experimental de  
hipertensión portal y ascitis.**

Los Autores han producido en perros hipertensión portal y ascitis mediante una constricción parcial de conducto biliar común y presentan los resultados histológicos, radiológicos y fisiológicos.

**J. NIELUBOWICZ, W. OLSZEWSKI, S. SZY-  
FELBEJN**

**Eine Methode zur experimentellen Entwick-  
lung der portalen Hypertension und  
Ascites.**

Die Autoren berichten über eine Methode mit der im Hunde-experiment durch partielle Stenosierung des Ductus hepaticus communis Hypertension und Ascites hervorgerufen werden können. Sie berichten über die histologischen, radiologischen und physiologischen Resultate.

**J. NIELUBOWICZ, W. OLSZEWSKI, S. SZY-  
FELBEJN**

**Metodo per la produzione sperimentale del-  
l'ipertensione portale e dell'ascite.**

Gli A. hanno prodotto nei cani ipertensione e ascite con una costrizione parziale del dotto biliare comune e presentano i risultati istologici, radiologici e fisiologici.