

Lecture N. 21

Portal Hypertension

The portal venous system collects blood from the sub-diaphragmatic structures of the gastrointestinal tract to carry it - via, as the name implies, the portal vein - to the intrahepatic vascular network. We thus have a hemodynamic space closed between the splanchnic vascular microsystems and the intrahepatic system. It's therefore fully understandable that, under such conditions, an increase in resistance downstream (the hepatic network) or an increase in the flow of blood to the splanchnic venous system, can easily provoke a modification in pressure in this space. These, in short, are the possible causes of the "**syndrome of portal hypertension (PH)**."

We cannot perceive the how and why such a syndrome arises without first understanding the **anatomy of the portal venous system**. It's therefore wise to dwell for a moment on this subject.

Blood from the intestinal, pancreatic and splenic micro-circulation drains into venules and then into increasingly larger veins that ultimately merge into three main branches: the splenic vein, the superior mesenteric vein, and the inferior mesenteric vein. The first drains blood from the spleen (as its name suggests) and from the pancreatic body, the second, too, from the pancreas and the small intestine, while the third drains the large intestine and colon. The splenic and superior mesenteric veins merge to form the portal vein; the inferior mesenteric vein, on the other hand, usually flows into the splenic vein or, more rarely, into the superior mesenteric vein or into the angle of the splenic-mesenteric confluence.

The portal vein generally measures approximately eight centimeters in length and one and a half or slightly more (hardly ever more than to two) centimeters in diameter. It runs along the so-called hepatoduodenal ligament, behind the common bile duct and the hepatic artery. With these elements the hepatic hilum is formed. From here, the vein dilates slightly ("portal sinus") and divides into right and left branches that descend into the liver, giving rise to veins and venules that carry portal blood to the microfiltrating hepatic sinusoids where venous blood mixes with arterial blood transported by the hepatic artery. Here, within the lobes, blood undergoes the biochemical rearrangement performed by hepatocytes and Kupffer cells. Thereafter, blood is carried to the central hepatic veins and from there to the hepatic veins which empty into the inferior vena cava. Small vessels reaching the liver from the gall bladder, the greater omentum, the lesser curvature of the stomach and the diaphragm, but not belonging to the portal system proper, go by the name "accessory hepatic portal veins". Small veins from the abdominal wall may also merge into the paraumbilical veins that reach the liver via the round ligament structure; they may also connect with the umbilical vein when this is patent. In this case, this latter vessel connects to the left branch of the portal vein.

We will see further on that a patent umbilical vein may become a collateral source of portal circulation, and in this case can provoke so-called “caput medusae”.

Because nature provides for all, every vascular system is endowed with accessory pathways that are “switched on” in the event circulatory difficulties arise, be these due to obstructive phenomena or to increases in blood flow. In venous systems these compensating mechanisms generally have the task of draining blood into more viable vessels that allow its return to the heart. This happens in the portal system, as well, when an increase in pressure occurs within, above all because of obstructive phenomena. Blood of splanchnic origin is therefore forced to return to the heart via anastomotic veins with the inferior and/or superior vena cava: the collateral circulatory pathways. We will see how this remedy that nature offers may create high-risk situations and negatively characterize the syndrome of portal hypertension.

The collateral circulatory pathways are activated when necessary in four regions: the gastroesophageal junction including the splenic area, the anal canal, the anterior abdominal wall and the retroperitoneum. In the region of the superior mesenteric and splenic veins, the following vessels are activated (among others): the gastroepiploic veins, the short vessels, the submucosal venous plexus of the stomach, and the esophageal and periesophageal submucosal vessels at the gastro-esophageal junction. Here they connect to the venous network of the thoracic esophagus that drains into the superior vena cava via the azygos and hemiazygos veins. In the anal canal, the hemorrhoidal plexus drains upwards into the superior hemorrhoidal vein, a tributary of the inferior mesenteric vein, and downwards into the middle and inferior hemorrhoidal veins, which merge in the hypogastric veins and thus in the inferior vena cava: an inversion in flow from the portal to the inferior caval territory is as a result easily achieved.

If, as already mentioned, the umbilical vein is patent, the flow of the portal vein’s left branch (to which the umbilical vein is connected) may be inverted to the peri- and parumbilical veins, all of which are tributaries of the vena cava. Numerous venous formations branch out into the retroperitoneum from the retroperitoneal parts of some organs, including the duodenum, pancreas, the ascending and descending colon, to form the so-called space of Retzius, which drains in various ways in the area of the vena cava.

Under normal conditions portal venous pressure is 10 - 12 H₂Ocm, compared to 0 H₂Ocm in the inferior vena cava. An important gradient in the two systems’ pressure values thus exists, and this ensures the hepatopetal flow of blood in the in the portal domain. Of course, the impulses of the hepatic artery, contractions of the diaphragm, vessel tone and, to some extent, a presumable pressing action of the spleen, all contribute - be it only less significantly - to this hemodynamic effect.

When, however, conditions arise wherein portal flow is obstructed or, even if to a minor degree, there is an increase in blood flow, portal pressure rises also considerably, at times exceeding 50 H₂Ocm. Here then is when the anastomoses described above become bona fide collateral circulatory pathways, assuming their derivative function of draining into the caval system veins.

In these conditions, and if for some congenital malformation it is not closed, Aranzio's duct (that connects the patent umbilical vein to the left suprahepatic vein), may even begin to function.

It is at this point that the negative circumstances alluded to above may establish themselves. In fact, at the gastroesophageal junction, in both the esophagus and the stomach (especially the gastric fundus), the sub-mucosal veins belonging to the azygos venous system swell until they become authentic varicose dilatations: **esophageal varices**. As we will see below, the rupture of these can become the source of serious and often torrential hemorrhaging. Similarly, the same occurs in the hemorrhoidal plexus with the formation of symptomatic anorectal varices better defined as **secondary hemorrhoids**.

As already mentioned, portal hypertension knows two fundamental causes: obstruction of portal vein blood flow or increase blood flow to the portal vein system.

Portal hypertension from obstruction

Obstruction of portal blood flow may vary in nature and, above all, in localization, which may be one of three: a) prehepatic (portal or radicular); b) intrahepatic; c) suprahepatic.

a/1 Prehepatic portal obstruction. The obstruction occurs precisely in the portal trunk. It is frequently either a primitive or secondary thrombotic occlusion. In the latter case, the cause could be infective, toxic or traumatic (post-traumatic). Portal vein atresia due to a congenital malformation may also clearly create a serious obstruction to portal vein patency. The obstruction may still again be caused by compression from a mass extrinsic to the vein. Especially after thrombotic occlusion, a so-called portal vein cavernoma may arise, which is nothing other than an attempt of recanalization through newly formed vessels that do not, however, have a flow capacity such that allows them to suitably substitute the portal vein.

a/2 Prehepatic radicular obstruction. As its name implies, this occlusion occurs in the tributaries of the portal vein. This thus gives rise to territorial hypertension: the hardest hit territory is the splenic vein usually due to thrombotic events. The foregone result of such an occurrence is splenomegaly. In this case, as well, important collateral pathways are formed, and these, too, are territorial (the short vessels, the gastric venous plexuses, the tributaries of the azygos veins).

b) Intrahepatic obstruction. This is the most frequent and most serious cause of portal hypertension. It is the most serious because of a particularly severe and progressive intrinsic disease: **hepatic cirrhosis**.

There are numerous anatomopathological forms of cirrhosis (hypertrophic, biliary, schistosomal, etc.), but that which most often is involved in the etiopathogenesis of portal hypertension is Morgagni-Laennec atrophic cirrhosis. The commonest causes of this disease are alcohol abuse and viral hepatitis, which subject the liver to serious damage. Hepatocytes undergo regressive and necrotic processes; sclerotic phenomena arise first in perilobular then in endolobular portal spaces; parenchymal atrophy progressively sets in, and attempts to compensate by means of nodular regeneration of hepatocytes and biliary ductules; the reduction of portal vein flow secondary to these phenomena induces a substitutive compensatory action by the arterial vascularization. All of these factors constitute the etiopathological sequence of events that lead to atrophic cirrhosis of the liver.

c) Suprahepatic obstruction - Budd-Chiari syndrome. Here, resistance is due to occlusion of the suprahepatic veins, which may result from varying causes, such as thrombotic processes, aplasia, venous membranes, etc.. It is a rare disease whose etiological features are little known; indeed, most cases are described as cryptogenic or idiopathic. Chronic forms have been reported that induce, in addition to portal vein hypertension, hepatopathy also with an evolution towards cirrhosis, subicterus and ascites. Acute and complete obstruction leads to very serious hepatic insufficiency with a rapidly fatal outcome: such cases constitute the fulminant form of the disease.

Portal hypertension from increased blood flow

According to elementary laws of hemodynamics, modifications in the pressure of a vascular system may be the consequence of an increase in resistance (as we saw above) or of an increase in blood flow. Should this latter arise, an imbalance is created between the vascular bed and the mass of blood that it must contain; a functional obstacle is thus established that impacts with greater pressure on the areas upstream.

The causes that can underpin portal hypertension of this type are multiple and are found at various levels in the tributaries of the portal tree: within the spleen, in the mesenteric tributaries, in the large vessels supplying blood to the liver. Noteworthy also are those conditions in which, even in the presence of an intrahepatic obstruction, hemodynamic modifications are seen which poorly lend themselves to interpretation as the exclusive consequence of stasis and which suggest the possibility of compensatory mechanisms.

On the basis of these concepts we can thus distinguish two situations:

- a) portal hypertension from absolute increase in blood flow (absence of any prehepatic, hepatic or suprahepatic obstruction);
- b) portal hypertension from relative increase in blood flow (presence of a hepatic obstruction).

As far as the first, **PH from absolute increase in blood flow**, is concerned, we can first of all take into consideration intrasplenic causes. If we accept the premise that a rise in pressure in a vascular system can be achieved (as we have said) by an increase of the mass of circulating blood, then important primary splenomegalies are able to cause such a situation. The prehepatic vascular bed and consequently the blood flow increase considerably, if we take into account that the fact that an organ that normally weighs 100-120 grams can for different reasons reach a weight exceeding one kilogram. Indeed, in our experience we have seen spleens weighing 7-8 kilograms.

So-called congestive splenomegaly is among the splenopathies most often suspected as being responsible for increased blood flow to the portal vein basin. This form creates an alteration of flow in the organ, above all due to a disturbance in intrasplenic arterial regulation with a consequent blockage of blood. For many authors, this is easily explained by the structure of the splenic vasculature and particularly the mechanisms regulating intrasplenic arteriovenous anastomoses.

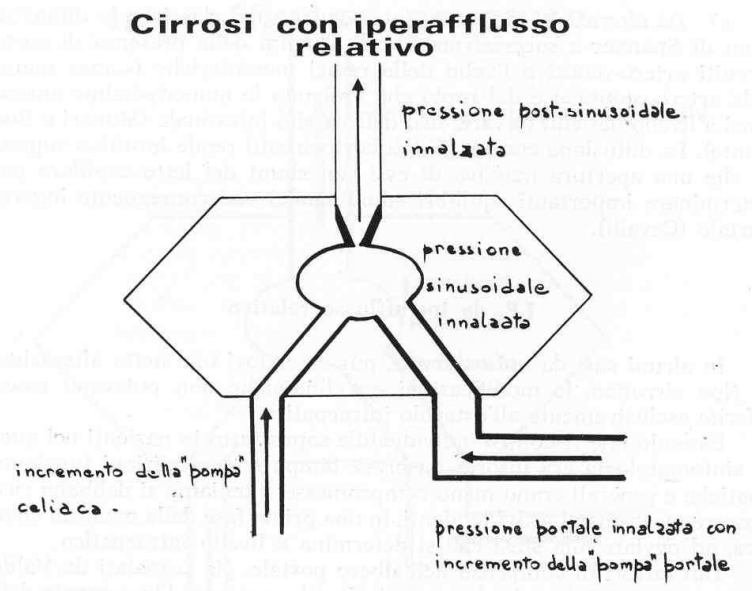
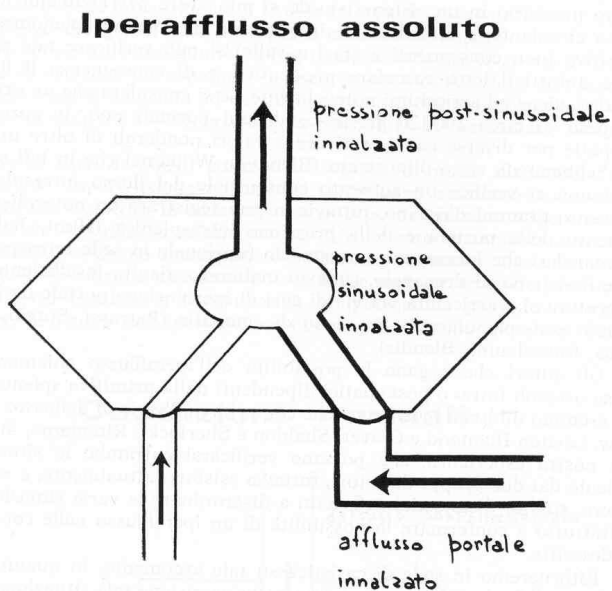
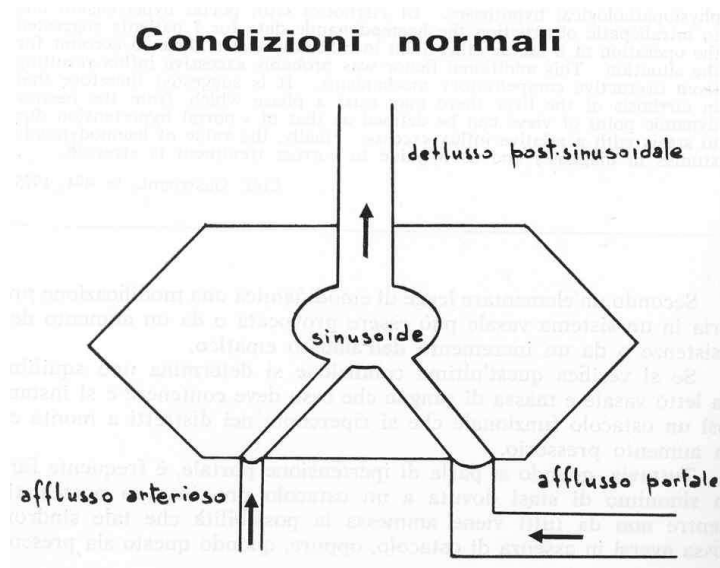
Other causes of PH from absolute increase in blood flow are arteriovenous fistulae: the direct communication of a venous branch of the portal vein system with an adjacent arterial branch leads to an increase of high pressure flow in the downstream tract of the portal vein with resulting hypertension. Situations of this kind have been described for splenosplenic arteriovenous and hepatic artery - vena cava fistulae. In many cases, these fistulae are secondary to arterial aneurysms or even, according to some reports, to surgical outcomes. Called into play in this type of PH are alterations of intestinal circulation, such as arteriovenous short circuits of mesenteric vein tributaries or of villi in various phases of intestinal activity.

The second possibility, **PH from relative increase in blood flow**, regards those cases in which, even though a cirrhosis-like hepatic alteration is apparent, hemodynamic modifications cannot be traced exclusively to the intrahepatic obstruction. Since this finding is detected above all in patients whose symptoms have only recently become manifest and whose hepatic and general conditions are not yet compromised, it is possible to recognize in these cases active mechanisms tending in a first stage of the cirrhotic disease to obviate the stasis that is created in the liver. Such mechanisms, aimed at overcoming the increase in resistance by means of a greater *vis a tergo*, are presumed to be achieved via splenic and intestinal short circuits.

In this phase, the splenomegaly is thought to take on an active significance that differs greatly from that which it assumes at an advanced stage of cirrhosis, when it represents merely a large bloody lake secondary to the stasis. Another contribution to this compensatory activity is thought to arise in the arterial component with the strengthening of the celiac and likely also the mesenteric propulsive apparatus.

This hypothesis is upheld by the frequent operative and angiographic findings of arterial branches of the celiac trunk that are ectasic, tortuous and strongly pulsating, features suggesting an increase of blood flow in these.

This situation is, of course, only temporary, because when the collateral pathways come into play routes of less resistance are created that encourage the transport of blood from the portal system and annul those mechanisms aimed at overcoming the obstacle.



At this point we cannot overlook mentioning Guido Banti, physician and pathologist who years ago identified and described the disease that now bears his name: **Banti's disease**. This disorder is characterized by a sequence of pathological signs that begin for unknown reasons with splenomegaly of a fibrocongestive type. Thereafter, increased blood flow in the portal vein system, hypersplenism (anemia, granulocytopenia, thrombocytopenia), and at a later stage, hepatopathy that evolves into cirrhosis eventually set in.

This would thus have been an initial indication of PH from increased blood flow; numerous works have attempted to define from an etiopathogenic standpoint this disorder, which would later be labeled bantian syndrome. The subject of continued studies today, syndromes of PH from increased blood flow are now known by authors who deal with them most as "idiopathic portal hypertension", and in all cases an important, apparently primary, splenomegaly is seen. Many works have reported pathological consequences on the liver parenchyma (Antunovic P. et al.: Srp Arh Celokn Lek - 1996; Tokushige K. et al.: Nippon Geka Gakkai Zasshi - 1996; Nakanuma Y.: Pathol Res Pract - 2001; Dhiman RK.: J Gastroenterol Hepatol - 2002).

Symptomatology of portal hypertension syndromes

This title should be considered first and foremost indicative, since the symptoms accompanying PH are generally referable to the disease that causes it. As stated earlier, the most frequent cause of the syndrome is atrophic cirrhosis, which induces intrahepatic obstruction in the sinusoids, and, as such, it is especially to this that it must be traced. The resulting symptomatology reveals the consequences of the liver damage that the disease induces and that is expressed in deterioration, anemia, hypoproteinemia with an inversion of the albumin/globulin ratio (which, if prolonged, will cause ascites), urobilinuria, increase of serum bilirubin, compromise of coagulation factors (e.g., drop in prothrombin time, etc.), thereby facilitating hemorrhaging, and frequent gynecomastia due to failing hepatic factors of hormone regulation. The liver's capacity to inactivate toxic substances normally filtered by the organ is progressively reduced: the most important manifestations that arise depend fundamentally on the increase in circulation of ammoniac substances (hyperammonemia), which can lead to neuropsychological disorders (emotional disturbances, amnesia, disorientation, etc.) that may ultimately give rise to so-called hyperammonemic encephalopathy.

Splenomegaly is always present in forms of PH due to intrahepatic occlusion, but may become significantly relevant in PH from prehepatic occlusion and above all in those forms which go by the definition of bantian syndromes and which may be accompanied by signs of hypersplenism. In Budd-Chiari syndrome liver damage occurs at a later stage, but ascites form more often and earlier.

We can thus say that the true and proper symptomatology PH is that deriving from the presence of collateral circulation, first and foremost those that are responsible for **esophageal varices**. It must be pointed out that, more often than is believed, these may also involve the subcardial tract of the stomach in addition to the terminal esophagus. The rupture of these varicose formations and the hemorrhaging that ensues considerably aggravate the severity of the syndrome. Hemorrhaging occurs when the expansive endovaricose pressure exceeds venous wall tension. Other factors, beyond purely hemodynamic ones, include concomitant esophageal lesions caused by cardiac incompetence, which are anything but infrequent in this disease: the varicose walls may easily be involved with these phenomena. It is estimated that nearly a third of patients with cirrhosis are affected by esophageal varices, and that 20% of these face hemorrhaging, the frequency and danger of which are proportional to the degree of liver damage. Many cohorts report a mortality rate following a first hemorrhagic event of no less than 50%. In the seven to 10 days thereafter, a large number of patients (20-50%) hemorrhage again; roughly 60% will experience massive hemorrhaging at a later date; within one year after the first event 70% will die. We must, in fact, acknowledge that here exists a vicious cycle: liver damage facilitates the risk of hemorrhaging, while hemorrhaging worsens liver failure.

Since variceal hemorrhaging prevalently affects patients with cirrhosis, physicians realize the risk and almost always expect it, even if the event often occurs without particular warning signs. Completely different are the conditions in which the hemorrhagic event manifests because of a different form of PH: in these cases bleeding is unexpected, and the unpredictability of the event may lead to serious risks owing to delayed diagnosis and/or treatment.

The disorder appears with hematemesis. The blood is a scarlet red, seemingly arterial in origin and certainly not the color of venous blood, and generally free of clots. Blood is emitted in large quantities by regurgitation, to the extent that rapidly deteriorating hypovolemic shock sets in. These features unequivocally reveal the origin and nature of the hemorrhaging. Subsequently, melena naturally ensues

As stated above, the collateral circulation of the hemorrhoidal system may reveal itself with **symptomatic hemorrhoids**. In some instances, these too may give rise to profuse bleeding, thereby requiring intervention. If events of this nature do not appear, however, it is preferable to avoid surgery, since this collateral circulation is able to relieve the pressure created by more dangerous collaterals, such as that described above.

Diagnostics

Diagnosis is based above all on the patient's history and physical examination: in short, on clinical data. It is in this work-up stage that it becomes clear whether PH depends on a liver-related cause, e.g., cirrhosis, or on another condition, for instance a relevant splenomegaly, which could induce a different approach.

As we have said, since the most common and most serious cause of PH syndrome is hepatic cirrhosis, we will first dwell in this paragraph on diagnostic procedures, which must assess, even before the situation of portal vein circulation, the state of liver function. Indeed, already during the collection of patient history many symptoms can yield details on this question: asthenia, anorexia, neuropsychological phenomena, etc. Physical examination, as mentioned above, will reveal nutritional status, phenomena of fluid retention (edemas, ascites), palpatory signs of hypochondriac organs, cutaneous teleangectasias (so-called "vascular stars" or "spider veins"), and the eventual "caput medusae" (clear manifestation of PH). Thereafter, the laboratory tests detailed above must be performed.

These are the elements that allow evaluation of hepatic function in cirrhotic patients; according to detected values, risk categories have been established that, as we will see below, take on importance above all in view of possible surgical procedures. The Child and the Child-Pugh scores are the most widely known.

Classificazione di Child

Gruppo	A – lieve	B – medio	C – grave
Bilirubinemia (*) mg %	< 2,0	2,0 – 3,0	> 3,0
Albuminemia gr %	> 3,5	3,0 – 3,5	< 3,0
Ascite	assente	controllata	non controllata
Disordini neurol.	assenti	lievi	gravi - coma
Nutrizione	buona	sufficiente	scarsa

(*) ambigua nella cirrosi biliare

Classificazione di Child – Pugh

Gruppo	A – lieve	B – medio	C – grave
Bilirubinemia mg %	< 2,0	2,0 – 3,0	> 3,0
Albuminemia gr %	> 3,5	2,8 – 3,5	< 2,8
Tempo (secondi ++)			
Protrombina	1 – 3	4 – 6	> 6
Ascite	assente	lieve	moderata
Encefalopatia	“	“	severa - coma

Instrumental diagnosis has the task of assessing the conditions of portal vein and, if necessary, collateral circulation, with special attention being given to esophageal varices. The detection and study of these latter are optimally achieved with radiography and esophagogastroscopy.

Endoscopy enables the direct vision and study of varices that, if present, occupy the submucosa of the lower third of the esophagus. As already mentioned, signs of esophagitis caused by reflux may be revealed. Above all, the test allows for the evaluation of size of the varices and for the possible presence of red stigmata, considered an indicator of possible, imminent variceal rupture. Endoscopy may also detect varices in the gastric fundus, as already said, and the relatively frequent occurrence of congestive gastropathy, which is secondary to an increase of blood flow and venous pressure in the stomach walls. Erosive gastritis (bleeding) and ulcerative lesions are also not uncommon findings.

Ultrasonography (US) is a non-invasive method that serves many purposes. It is the preferred examination for the study and the morphology of the portal vein system and possible collateral circulation. Beyond measuring the diameter of the portal vein and its affluents, Doppler US and velocimetry can reveal the presence or lack thereof of blood flow and its characteristics: hepatofugal or hepatopetal flow, turbulence, capacity. It goes without saying that US yields information on liver structure, as well as on the presence and quantification of possible ascites.

Finally, angiography is a very important tool for the morphological study of the portal vein system (Fig. 1).

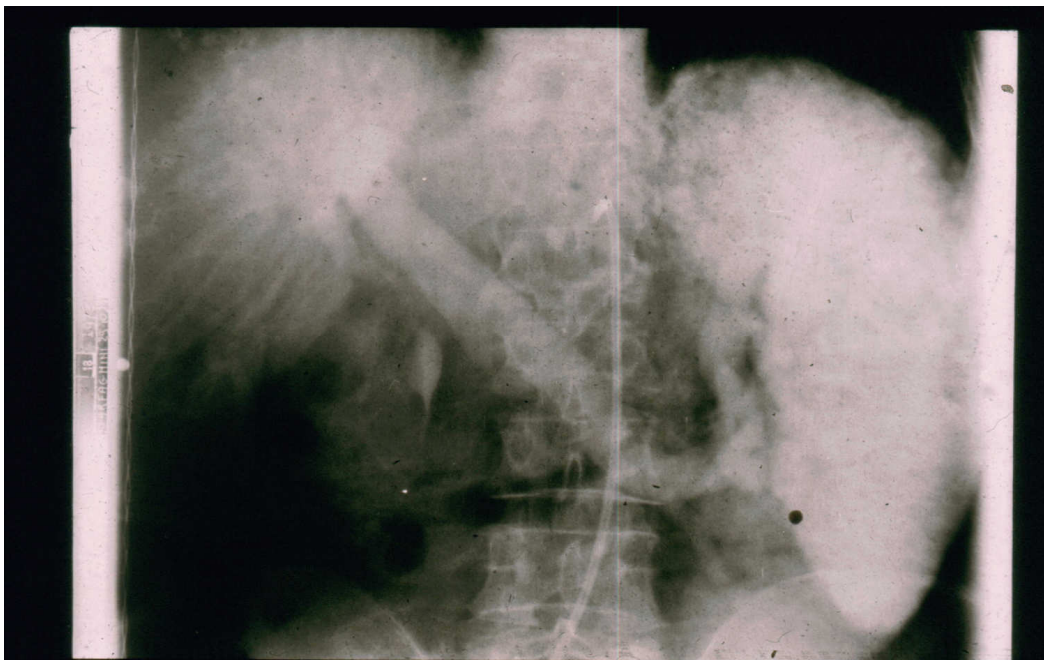


Fig. 1

Selective arteriography, splenoportographic phase. Noteworthy splenomegaly, dilation of splenoportal venous axis and verticalization of the portal vein: indices of portal hypertension.

The identification and related evaluation of the various situations of PH are based essentially on examinations of hepatoportal hemodynamics through the calculation of the following parameters:

- Sinusoidal pressure
- Post-sinusoidal pressure
- Hepato-suprahepatic gradient
- Hepatic flow
- Hepatic resistance
- Suprahepatic oximetry
- Splenic pressure
- Splenohepatic gradient
- Time of splenohepatic circulation

These parameters are obtained by means of delicate and highly specialized procedures of selective catheterization.

Therapy

As already stated, the most serious and most dangerous event faced by the patient with esophageal varices is **hemorrhaging**. While this may be modest in extent, in most cases it is dramatically torrential. We thus have two types of bleeding: in the first pharmacological treatment aimed at reducing pressure within the portal system may be attempted. The drug most often used is vasopressin (neurohypophysial antidiuretic hormone - ADH), which exerts a strong vasoconstrictive action. Administered in continuous infusion together with nitroderivatives, it is able to control the hemorrhaging in a high number of cases (up to 80%), but it has a short half-life, may give rise to adverse reactions (antidiuretic effect, arterial hypertension, etc.) and once the infusion is suspended hemorrhaging easily resumes. An analogue of vasopressin, glipressin (terlipressin), yields similar results, has a longer half-life, may be administered in bolus instead of continuous infusion, provokes fewer adverse effects, and reduces portal vein pressure by more than 30% and portal vein blood flow by 40%. Somatostatin and its analogue octeotide may also be used to achieve results that parallel those above on splenic circular flow and with fewer undesired collateral effects.

But hemorrhaging is more often than not massive, to an extent that it rapidly creates conditions of hypovolemic hemorrhagic shock. Attempting to tame such an event pharmacologically would be deceptive. In these circumstances, the attending physician has two objectives: intensive care and intervention to reverse shock, namely with crystalloid fluids, blood substitutes such as dextrans, plasma and derivatives, and naturally blood transfusions. Simultaneously, the hemorrhaging must be stopped. Practical reasons and especially the difficulty of managing a tube full of continuously and violently gushing blood make any attempts at endoscopic hemostasis useless.

This is why the first step to rapidly stop bleeding is by tamponade with the *glorious **Sengstaken - Blakemore tube***: glorious, indeed, because thanks to this device patients at high risk of mortality are saved.

The tool is a three-way tube: one reaching the stomach is used for gastric emptying (less blood passing into the intestine means a lower risk of post-hemorrhagic encephalopathy); a second tube is attached to a balloon that is positioned below the cardia in the gastric fundus; a third tube is attached to another elongated balloon placed above cardia in the lower esophagus.

The tube is inserted through the nose, obviously with the balloons deflated. As soon as the distal balloon has penetrated into the stomach, it is inflated and traction is applied so that the balloon stops below the cardia: this is an especially important maneuver, as it ensures that the balloon is firmly anchored in its intended position below the cardia. At this point the tubular endoesophageal balloon is inflated to a pressure of approximately 30 mmHg.

The tube is placed under moderate continuous traction by means of weight at its external end. In our experience we usually prolonged the tube by attaching a cord appropriately placed under traction by means of a weight (an IV bottle or bag) at its external end. The pressure in the esophageal balloon must be scrupulously monitored by manometer so that it becomes insufficient if low, or dangerous for the esophagus if too high. This is why it is advisable to reduce internal pressure at periodic (approximately one hour) intervals. Careful and continuous surveillance of patients is imperative, because if the gastric balloon deflates, the tube no longer remains anchored and is pulled upwards by the weight, thereby displacing the esophageal balloon, which, still inflated, creates a laryngeal-tracheal obstruction that seriously compromises respiration. The pressure in the two inflated balloons is able to compress the varicose swellings in both the esophagus and the gastric fundus, thus achieving hemostasis. After some time (12 - 24 - 36 hours, depending on tolerance), the tube is removed. Hemorrhaging has stopped, is minor in nature or may resume, at times to a greater extent.

In any case, once the tube is taken out the patient must be entrusted to an endoscopist. Fiber endoscopy allows for the successful treatment of esophageal varices by means of obliteration achieved with the endo- and/or peri-varicose injection of substances that are either sclerosing (sclerotherapy) or stagnating (acrylic glue, bucrylate, etc.). More recently endoscopic ligation of varices has gradually replaced sclerotherapy with better outcomes: fewer treatment sessions needed for eradication, a lower rate of complications, and a lower incidence recurrent hemorrhaging.

If, however, none of these procedures resolves the hemorrhaging symptomatology, only one alternative remains. This cannot be a major operation such as, for example, a portosystemic shunt, because it would not be tolerated by a patient already in serious condition, especially with regard to liver function.

In these cases, it is advisable to resort to an interventional radiologic procedure: **Transjugular Intrahepatic Portosystemic Stent Shunt (TIPSS)** (Rosch, Richter). In this procedure, a catheter is introduced through the jugular vein and advanced into a suprahepatic vein; within the catheter a metal guide wire is advanced until it reaches a large branch of the portal vein, which it punctures; the catheter is then advanced along the guide wire and introduced into the portal branch; an angioplasty catheter, which dilates the intraparenchymal tract between the suprahepatic and portal branch, is introduced through the same guide wire; in the parenchymal channel thus achieved an expandable stent is introduced that creates a shunt between the suprahepatic vein and the branch of the portal vein; the pressure gradient (high pressure in the portal vein - low pressure in the superior vena cava, into which the suprahepatic vein drains) guarantees, at least temporarily, the portosystemic derivation and thereby the relief of tension in the portal vein system.

Thus far we have considered measures to take in emergency situations of esophageal varices hemorrhage. Now we must ask what to do once the hemorrhagic event has fortunately resolved. We know and have already pointed out that in a very high percentage of cases (60%) a second, more serious, hemorrhagic episode follows the first; it has been reported that in the first six weeks after a first hemorrhage the risk of recurrence reaches 75%. Thus it is that 70% of patients die after the first event, and death is often secondary to the recurring hemorrhage.

This is when **elective surgery** enters the scene. This entails the decompression of the portal vein system by means of portosystemic shunts that protect against rebleeding in more than 95% of cases.

Two types exist: truncular shunts, which consist of direct portacaval anastomosis; radicular and selective shunts, represented by mesenterocaval, proximal splenorenal, and distal splenorenal (Warren) anastomosis.

Portacaval anastomosis may be created in two ways: end-to-side (E-S) and side-to-side (S-S). In the former, the portal vein is interrupted immediately before its bifurcation and the proximal end is anastomosed to the vena cava, precisely in a E-S fashion; in the latter, the portal vein is left intact and is anastomosed to the vena cava in a S-S manner.

Our preference has always been E-S anastomosis: S-S shunts, in fact, the high pressure gradient established between the two vessels exerts the suction of portal vein blood by negative caval pressure. This is desirable; what is undesirable is the suction, as well, of blood from the intrahepatic network (venous leakage), including the arterial component. Thus, this type of anastomosis is harmful to liver function. With E-S anastomosis all of the portal vein system blood is deviated, and this is good. Since it is proven that ligation of the portal vein at the “sine” (pre-bifurcation tract) increases arterial hepatic perfusion, tropism and liver function are preserved compared to S-S anastomosis.

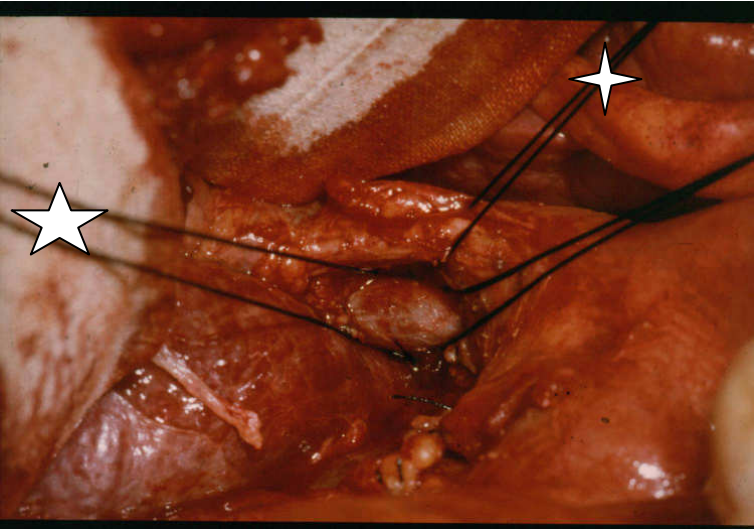


Fig. 2

☆ portal vein ☆ hepatocholedocus

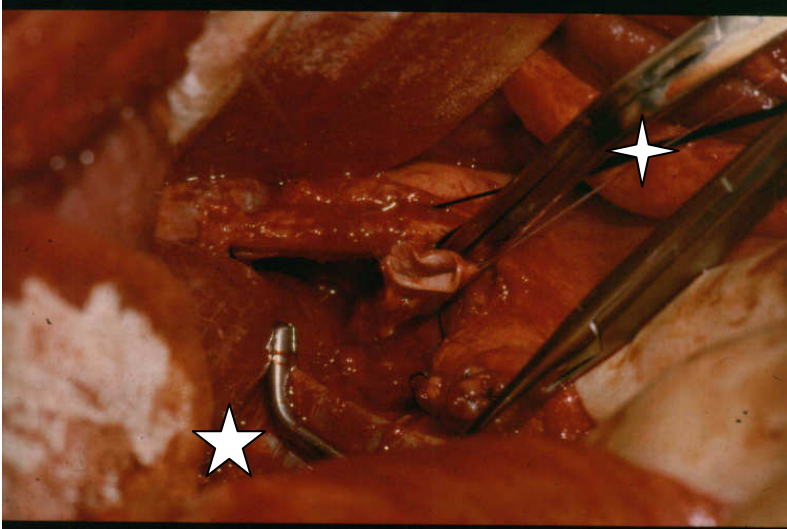


Fig. 3

☆ inferior vena cava ☆ portal vein stump

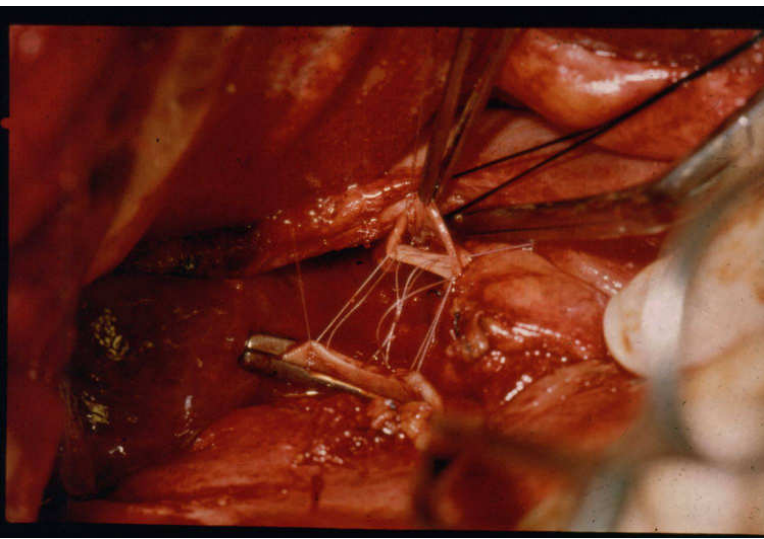


Fig. 4

posterior Blalock overcasting suture

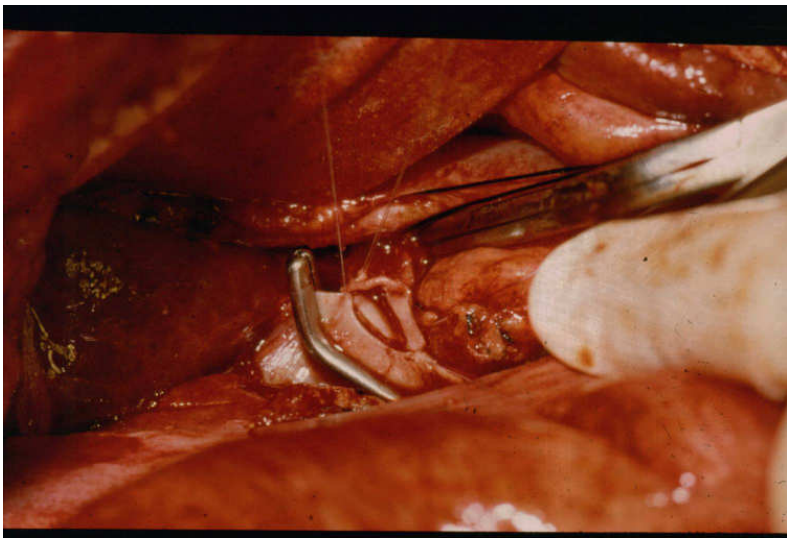


Fig. 5

the anterior simple overcasting suture begins

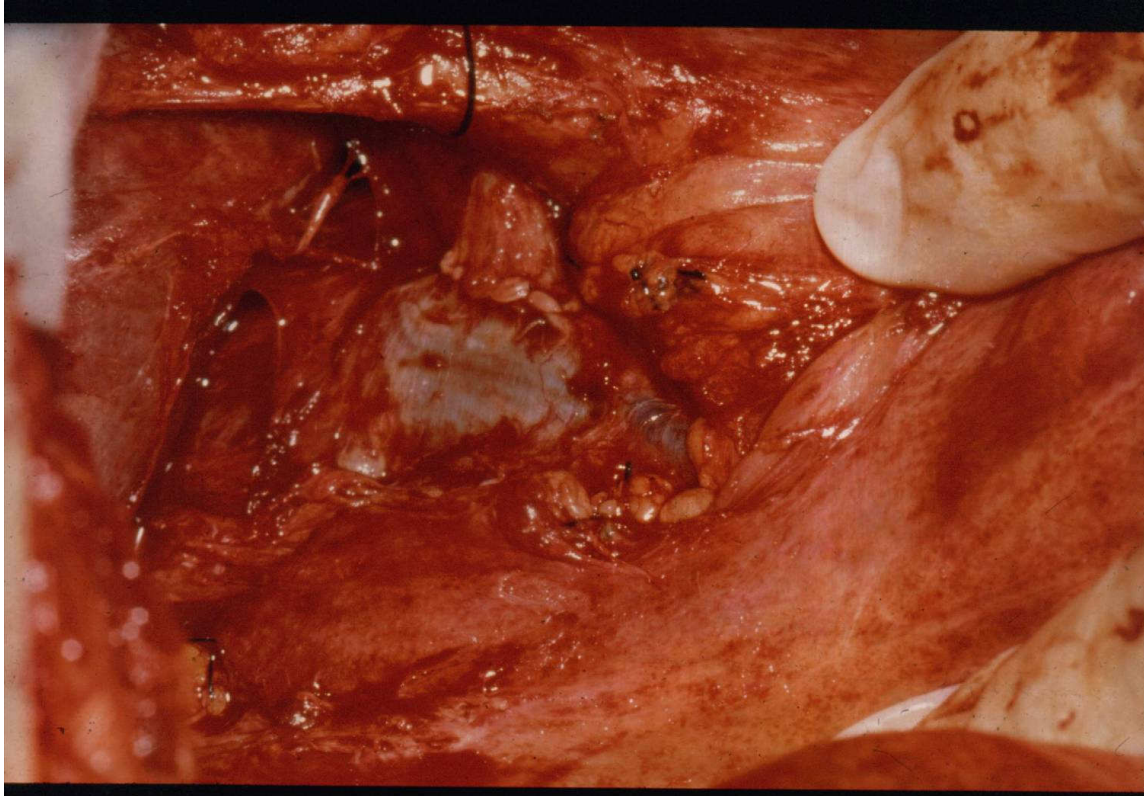


Fig. 6
E-S portocaval anastomosis completed

The portal-systemic derivation achieved through truncular anastomosis yields better results of portal distension with longer lasting effectiveness compared to radicular shunts, 10-20% of which carry a risk of occlusion. More important, selective shunts lose their characteristics with time. On the other hand, truncular shunts are burdened by a 30-40% incidence of hyperammonemic encephalopathy compared to 10-20% for radicular shunts and 10-15% for selective shunts.

Hyperammonemic encephalopathy resulting from truncular shunts sets in because detoxification by the liver occurs arterially after ammoniacal substances have amassed in the brain. This condition may severely handicap the patient: dietary treatment and other therapeutic provisions may nonetheless reduce the burden of this secondary disease.

Likewise, TIPSS comes into play in this treatment stage. This method, however, has its limits: high incidence (75%) of stenosis and late occlusions that require either prompt dilation in order to maintain the shunt's secondary patency or the reapplication of stents. This derivative procedure, too, is not without problems of hyperammonemia (25%).

Pharmacological treatment is indicated in patients with varices that have never bled; it is also used in attempts to prevent rebleeding. Noncardioselective beta-blockers can reduce flow in the splanchnic system, and a decrease in portal vein pressure with a putative reduction of hemorrhagic risk have been described in a number of cases. Nitroderivatives are also used for this purpose.

Endoscopic treatment of varices (sclerotherapy, endoscopic ligation, etc.) can, as we've said, yield outcomes that are certainly more impressive than those obtained with pharmacological medical therapies.

The extreme severity and related high risk of death legitimize the question of whether a feasible and acceptable prophylaxis of the first bleeding event would not be advisable. Strong with the conviction that "*the portosystemic shunt protects against rebleeding in more than 95% of cases*", many have asked whether - given the evidence of varices in the cirrhotic patient - it wasn't the case to apply this valid provision that no doubt protects against a first hemorrhagic event. To add to this, factors that would seemingly condition the onset of the disorder have been identified, namely: diameter of the varices and red marks on their surface, a portoatrial pressure gradient above 12 mmHg, and compromised liver function. Despite promising evidence, many controlled clinical studies have not confirmed the validity of prophylactic shunts, due principally to the high incidence of invalidating hyperammonemic encephalopathy and precarious conditions of liver function. These are two factors that, all things considered, account for reduced long-term survival. Prophylaxis must thus be either pharmacological or endoscopic.

Up until now we have discussed the treatment options that can arrest the serious consequence of PH from intrahepatic obstruction: esophageal varices and the related risks of hemorrhage. Underlying such dangerous circumstances, however, is the cirrhotic alteration of the liver, which is the primary cause of PH. We have seen how hepatic function conditions the severity of vascular consequences, the therapeutic choices (see Child and Child-Pugh risk classes), and the outcomes of varying treatments, which may be considered merely palliative since the true cause - cirrhosis - is not eliminated. As such, should variceal bleeding occur in a patient with signs of severe liver failure (Child C class, encephalopathy, ascites, etc.), removal of the diseased organ and orthotopic liver transplant may be considered. This is indicated also in some forms of Budd-Chiari syndrome.

Devascularization includes surgical procedures that interrupt blood flow to splenic areas and the so-called azygos roots, thereby achieving azygos-portal vein disconnection. The Sugiura procedure (Fig. 7) fundamentally entails splenectomy, interruption of the short vessels of the gastric fundus and of the proximal third of the greater curvature of the stomach, and isolation and ligation of the esophageal venous plexus. The Walker procedure (Fig. 8) consists of the direct interruption of the esophageal varices.

This may also be achieved by means of esophageal transection using a stapler via a gastrotomic approach. Such intervention strategies have been adopted as well against the risk of variceal hemorrhage from PH caused by intrahepatic obstruction. The results obtained in this case, however, are not comparable to those already described. A better application of these procedures is found for other forms of PH: prehepatic obstruction or, even more preferable, forms of excessive flow, above all when an underlying splenomegaly is present.

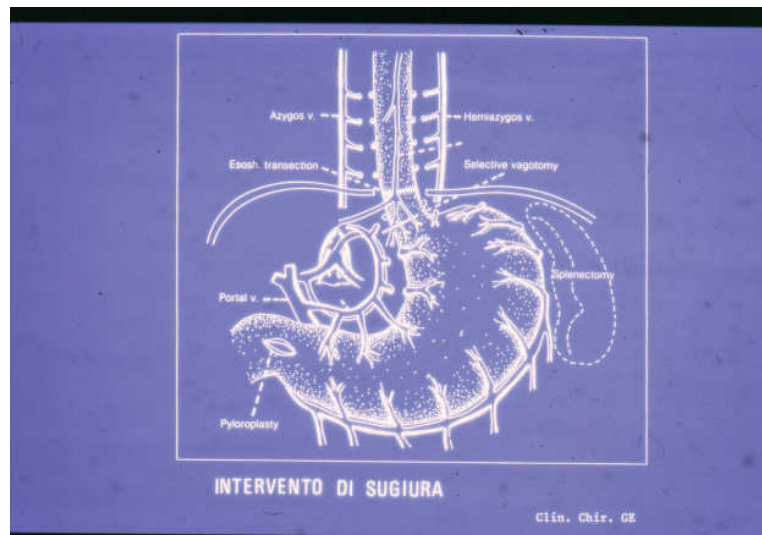


Fig. 7 - Sugiura procedure

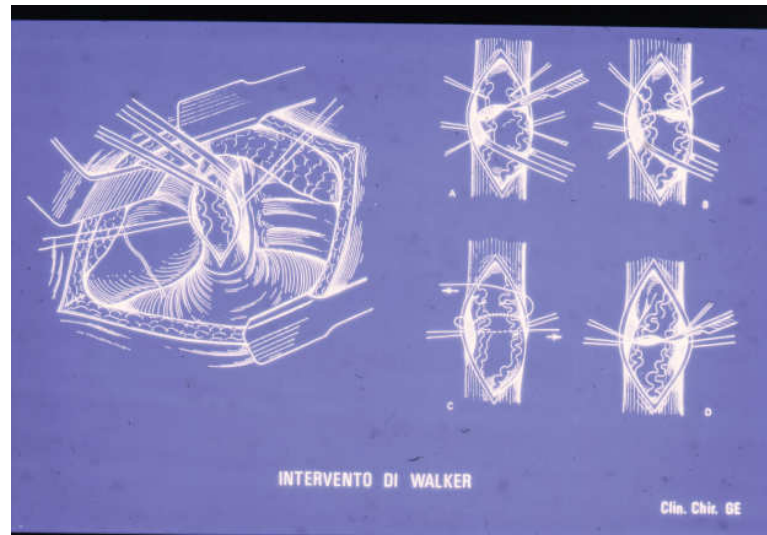


Fig. 8 - Walker procedure

In conclusion, the syndrome of portal hypertension still offers a number of interesting “talking points”, beginning with the physiological presumptions of the clinical picture. Relevant, too, are the myriad etiopathogenic factors that are potentially involved, many of which have the liver as their target (toxic, toxo-infective, and parasitic lesions; immunological disorders; congenital malformations; vascular malformations, etc.); still others lie beyond the hepatic area and are, nonetheless, able to alter pressure in the splanchnic region. Situations are thus created that can often give rise to potentially serious clinical relapses. Although appreciable outcomes have been achieved in recent decades, treatment of these organic-functional syndromes having portal hypertension as their common denominator is still subject to uncertainty and debate. Given the myriad of specialist skills and expertise enlisted in the attempt to resolve often vastly different clinical situations, therapies today truly deserve the label multimodal. The treatment of the individual patient, moreover, must be regarded as sequential in view of the succession of numerous events in the course of the disease.
