

# Connection types between portal vein and portal sinus during foetal life

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*We examined 27 resin casts of foetal liver veins and found three types of connection between portal vein and portal sinus. The most frequent connection was endo–lateral (66.7%), when the end of the portal vein joins with the lateral wall of the portal sinus. The next type was latero–lateral (14.8%). In this type, the lateral walls of the portal sinus and the portal vein join together. The last type was latero–lateral through short vessel (18.5%), which resembles the previous one, but there is short vessel between the lateral walls of the portal vein and sinus.*

**key words:** portal vein, foetal liver, porta hepatis

## INTRODUCTION

The venous vessels running to the foetal liver are very important for the normal development of the foetus. Of special significance is the umbilical vein, sometimes known as “the vein of life”, which supplies the foetus with oxygen, and all nutrient products from the placenta.

The umbilical vein originates from the placenta, and then passes inside the umbilical cord and enters the foetal abdominal cavity through the umbilical ring. Then it enters the porta hepatis. The end of the umbilical vein joins the portal sinus. It is a short vessel extended between the umbilical vein and portal vein [1–4,8]. After birth the portal sinus becomes the left branch of the portal vein.

Knowing the importance of the porta hepatis vessels for the developing foetus, we took as our aim the anatomical description of the connection between the portal vein and the portal sinus.

## MATERIAL AND METHODS

The 27 foetuses, aged 19–27 weeks of gestation, were obtained after spontaneous abortion or pre-term delivery. Then each foetus was injected with the resin (Batson Corrosion Kit) through the umbilical vein and aorta after thoracotomy. When the res-

in had become hard, the abdominal and thoracic organs were removed from the foetus. Soft tissue was macerated in the KOH solution at the temperature of 70°C. All small branches of the hepatic venous network were removed. The persisted, main trunks of the portal and umbilical vein were measured and analysed.

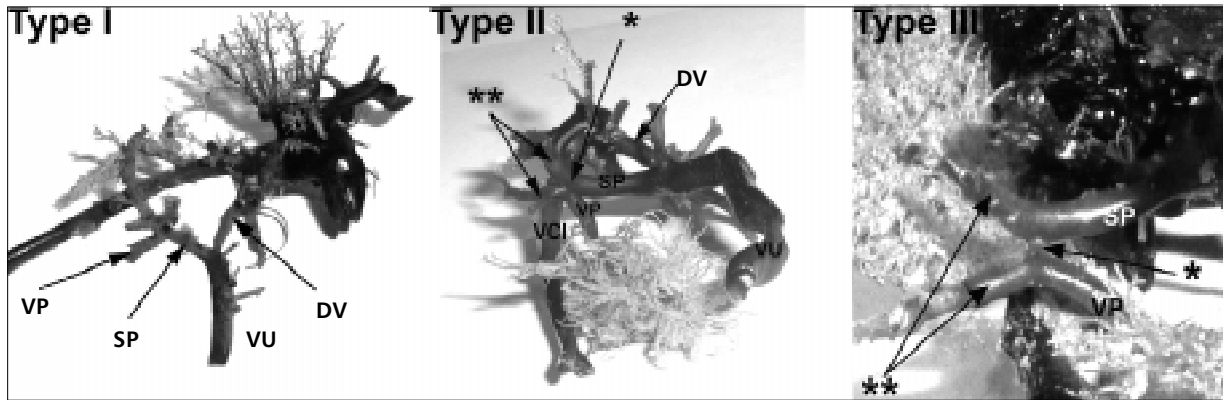
## RESULTS

We found three types of connections between the portal vein and the portal sinus (Fig. 1).

Type I, endo–lateral, was found most frequently. In this connection the end of the portal vein joins the lateral wall of the portal sinus. The angle between these vessels is nearly 90°. The next characteristic feature of this type is the presence of only one right portal vein branch.

Type II, latero–lateral. This type is characterised by a connection through the lateral walls of both vessels. In this type there are two independent veins running to the right lobe of the liver.

Type III, latero–lateral through short anastomosis. This type looks like type II, but there is a short joining vessel between the portal vein and the portal sinus. Additionally, there are two independent veins running to the right lobe of the liver.



**Figure 1.** Three types of connections between the studied vessels. Abbreviations: DV — ductus venosus; SP — sinus portae; VCI — vena cava inferior; VP — vena portae; VU — vena umbilicalis; \* the connection; \*\* branches to the right lobe.

### DISCUSSION

We found three types of connection between the portal vein and portal sinus. Type I appeared most frequently (Table 1). This explains why most authors are used to describing this connection as a typical one. It may be the truth for children and adults because foetuses with a different connection type could not develop normally, or because the anatomy of the adult portal vein is not investigated enough.

**Table 1.** The types of connection between the portal vein and portal sinus

Type	Number of specimens (%)	Estimated percent $\alpha = 0.05$
I	18 (66.7)	48.9 – 84.5%
II	4 (14.8)	1.41 – 28.2%
III	5 (18.5)	3.85 – 33.2%

It is worth remembering that the foetal liver may be presumed as an organ composed of two independent parts in the meaning of blood supply. The left lobe of the foetal liver is supplied by the umbilical vein. The right lobe is supplied, mostly, by the portal vein. This situation characterises type I. It's improved that blood from the portal vein does not flow to the left lobe of the liver [5–7]. This means

that blood from the portal vein turns right, after the connection between the portal vein and the portal sinus. The appearance of types II and III may cause the right lobe to be divided into two parts with a different blood supply. The umbilical vein mostly supplies the first part. The second is mostly supplied by the portal vein.

### REFERENCES

1. Champetier J, Yver R, Letoublon C, Vigneau B (1985) A general review of anomalies of hepatic morphology and their clinical implications. *Anat Clin*, 7: 285–299.
2. Champetier J, Yver R, Tomasella T (1989) Functional anatomy of the liver of the human fetus: applications to ultrasonography. *Surg Radiol Anat*, 11: 53–62.
3. Dickson A. D (1957) The development of the ductus venosus in man and the goat. *J Anat*, 91: 358–363.
4. Elias H, Petty D (1952) Gross anatomy of the blood vessels and ducts within the human liver. *Am J Anat*, 90: 59–111.
5. Emery JL (1952) Degenerative changes in the left lobe of the liver in the newborn. *Arch Dis Child*, 27: 558–561.
6. Emery JL (1963) Functional asymmetry of the liver. *Ann NY Acad Sci*: 111, 37–44.
7. Emery JL (1953) Involution of the left liver in newborn and its relationship to the physiological icterus. *Arch Disease Childhood*, 28: 463–465.
8. Schultz SR, LaBerge JM, Gordon RL, Warren RS (1994) Anatomy of the portal vein bifurcation: intra- versus extrahepatic location - implications for transjugular intrahepatic portosystemic shunts. *J Vasc Interv Radiol*, 5: 457–459.