Objectives To evaluate the efficiency of a newly proposed screening protocol in the examination of fetal hepatic circulation and to describe the variant and abnormal anatomy of targeted vessels and their influences on neonatal outcomes.

Methods This was a prospective study performed on low-risk singleton pregnancy women in four large academic tertiary referral care centers over more than 3 years period from August 2015 to December 2018. After traditional screening for obstetric malformations, a newly proposed screening method called four-plane protocol, comprised two transverse, one coronal and one longitudinal plane, was clinically used to assess the anatomy and function of the fetal hepatic circulation. The functional anatomy of fetal liver was evaluated according to the distribution of the portal vein branches as described by Couinaud, and other vessels in umbilical and systemic venous systems were assessed according to their origins, drainage and function. All fetuses were followed-up by ultrasound, or magnetic resonance imaging if necessary, every four weeks prenatally and every three months postnatally.
Results During the study period, there were six types of variants in fetal hepatic circulation. The common variants of fetal hepatic circulation includes persistent right umbilical vein, less or more than three hepatic veins, absence of the horizontal part of left portal vein, absence of the main right portal vein, angled superior and inferior branches of the left portal vein, more than one internal branches of the left portal vein. The common malformations of fetal hepatic circulation were partial or complete agensis of portal system, umbilical-systemic shunt with or without flow restriction, portal-systemic shunt, hepatic arterio-venous fistula, interuption of inferior vena cava, absence of ductus venosus and anomalous ductus venous return. Most of the above malformations had a good or acceptable prognosis, some required a close prenatal monitoring and premature delivery was the preferred option if necessary, a few required postnatal interventional or surgical correction and very few leaded to intrauterin death.

Conclusions The newly proposed four-plane protocol is an efficient screening method to detect the variants and abnormalities of fetal hepatic circulation during the second trimester. The variants of fetal hepatic circulation can happen in any part of umbiblical-portal-systemic venous system. Most of the abnormalities in fetal haptic circulation have good or acceptable prognosis, a few requires a close prenatal follow-up and postnatal intervention.