Modification of the method of corrosion casts for studying of bilio-vascular structures of liver

(Brief communication)

Inauri N.1, Kordzaia M.2, Sikharulidze I.2, Kakabadze M.3, Kordzaia D.3

Abstract

The description of the original method for preparation of corrosion casts of intrahepatic vessels and bile ducts is provided. Readily available compositions, such as "Protacryl- M" set widely used in dental and neurosurgical practice and the Latex manufactured by “Geng” used in different constructions/repairs were applied for the casting. It is demonstrated that corrosion casts of blood vessels and bile ducts obtained from above-mentioned resins obviously reflect the architectonics and surfaces of studied structures and are completely convenient for the macro- and microscopic observation. (TCM-GMJ January 2016; 1:P15-P17)

Keywords: Hepatic blood vessels, bile ducts, corrosion casts

Introduction

The study of spatial architecture of tubular structures – blood and lymphatic vessels, ducts, channels – by using the method of corrosion casts, belongs to one of the conventionally approved approaches. Application of the different stereo-microscopes (including scanning electronic microscope) make possible to study even the tiniest (capillary) branches with diameters of several microns.1,2,3,4

We aim to study the transformation of hepatic biliary and vascular architecture in regenerating liver of rats after partial hepatectomy by using of this method. For the preparation of corrosion casts of hepatic biliary and-vascular beds of big animals (dog/pig/rabbit), we previously used the latex manufactured by “Nairit”, which would coagulate in the acid - during the process of liver tissue corrosion.5 In smaller laboratory animals (rats) the cocktail including the monomer of methylmetacrilate, benzoyl peroxide and dimethilaniline was successfully applied for the same purpose.6

As observed recently, the production of Nairit’s latex has been ceased. Widely used resins like “Batsom” and “Mercox” successfully applied by various investigators for obtaining of corrosion casts, are expensive and their purchase/importation to Georgia is related to technical difficulties.

Actually, the injectable mass used in the casting of tubular structures has to comply with the following demands: be non-toxic, have low viscosity but coagulate fast, be resistant to corrosion solutions (acids/bases), maintain structural configuration after drying and preferably be compatible for staining with different colors (e.g., in order to allow the simultaneous study of hepatic veins, arteries and bile ducts).

For this purpose, we have tested: 1. "Protacryl- M" set widely used in neurosurgical and dental practice, including liquid and powder components in addition to 3 different color pigments for staining. 2. Latex, manufactured by “Geng” used in different constructions/repairs, resembling “Nairit” latex and at the same time easily stained with different colors.

Preparation of hepatic tubular structure cast samples was performed as follows:

The abdominal cavity of Wistar rat, weighting 200-250 g was opened under general ether anesthesia. The catheters with appropriate diameters were inserted in the portal vein and common bile duct (directed towards liver), and fixed with ligatures. The liver vessels were washed out via portal vein catheter with the cocktail including 100 ml 0.9% NaCl, 1.0 ml Atropine, 1.0 ml No-Spa, 1ml Heparin and 1 ml 2% Novocain. Outflow was achieved through femoral vein, which was cut previously. After washing out the liver (as it turned white), 1% formalin solution was injected into the portal vein,
followed by the injection of "Protacryl-M" cocktail ("Protacryl-M" powder 3 cm³ dissolved in 7.5 ml of its liquid component).

50-60 minutes later after injection of “Protacryl-M” (the term necessary for the solidifying of injected mass) the liver was excised and immersed into 20% NaOH solution for tissue corrosion, according to the previously described method. In several cases, the injection of “Protacryl-M” into the portal vein was followed by the injection of “Geng” latex via the catheter inserted into the common bile duct. In these cases, the excised liver was first immersed into the concentrated H₂SO₄ which led to the “coagulation” of latex. Later, the complete corrosion of liver tissue was done in 20% NaOH solution. It must be considered that immersion time in the concentrated H₂SO₄ for excised liver should not exceed 20 minutes, as the long-term storage of the specimen in the acid not only cause the coagulation of the latex, but can also dissolve the protacryl casts.

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Fig 1: Corrosion casts of rat’s liver blood vessels. A) Portal vein branches; B,C) Casts of portal vein branches and terminal portal venules; X 200; arrowheads indicate liver "lobules"; D) Casts of terminal portal venules and sinusoidal capillaries, X200; E,F) Corrosion casts of portal vein branches (blue) and bile ducts (white), X10;
The analysis of the casts prepared by the above mentioned method revealed that these casts evidently reflect the architecture of the studied structures; the obtained casts are sustainable, non-brittle and completely convenient for the relevant measurement of the volume or the length/diameters of the separate branches, including the measurement by stereo microscope. In cases of double injection, mobility (elasticity) of latex casts associated with the portal vein solid casts facilitates the better investigation of the relationship of these two structures.

The above mentioned demonstrates that the method of corrosion casts developed by us for modeling of tubular structures is completely relevant and can be successfully used in small laboratory animals for the assessment of architectural transformation of hepatic vascular bed and bile ducts in norm or pathology condition.

References

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