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Structural Peculiarities of the Blood Vessels of Major Duodenal Papilla as the Factor of Development of Bleeding by the Endoscopic Papillotomy.

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ABSTRACT

The paper is dedicated to the prevention of one of the most threatening complications of the endoscopic papillotomy – post-manipulation bleeding. The author has performed analysis of 24 bleedings after 2169 papillotomies in the gallstone disease complicated by choledocholithiasis. On the basis of the morphological examination of blood vessels of the major duodenal papilla the pre-conditions of this complication have been specified and the preventive measures have been suggested. An important practical conclusion is drawn that the loss of a part of sphincters as the result of papillotomy is the factor predisposing to the reduction of vasoconstriction, incompletely closed opening of the arterial and venous vessels and therefore to the increase in probability and severity of the post-papillotomy bleedings by the repeated endoscopic papillo-sphincterotomies.

Keywords: endoscopic papillosphincterotomy, morphometry, pancreatic duodenal vessels, anticoagulation reversal, post-papillotomy bleedings.

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INTRODUCTION

Among the complications of the endoscopic papillotomy (EPST) the main one is bleeding from the papillotomy incision appearing both during the intervention itself and within different period after performance thereof. This complication appears in 2-11% patients [1-6]. The main causes considered are the incorrect choice of the nature and strength of the cutting current, excessive cut length, topographic-anatomic abnormalities of the periampullary area vessels [1, 2]. An important part in the development of bleedings belongs to the coagulation disorders appearing as the result of the coagulation factors deficiency on the top of the long-lasting obstructive jaundice [7-10]. In the literature they also mention bleedings with underlying hepatic cirrhosis and related coagulation failures [9]. However, usually the appearance of this complication cannot be forecasted. At the same time the structural peculiarities of the intramural vessels of the major duodenal papilla (BSDK) are still understudied [3, 8]. Therefore, we have conducted the clinical analysis of the cases of bleeding after EPST and morphological examination of the papilla wall blood vessels.

MATERIAL AND RESEARCH METHODS

Our 20-year clinical experience is represented by 2169 papillotomies. At the average within the 2 periods of using various methods of intervention involving BSDK bleedings developed in 1,1 % cases. The clinically significant bleeding occurred in 24 patients and was rather mild (i.e., did not require transfusion) in 14 patients, moderately severe (required up to 4 blood bags) in 6 patients and severe in 4 (required transfusion of 5 and more bags). The severest bleedings (85 %) as well as all cases of severe bleedings occurred in patients with obstructive jaundice after sphincterotomy and in 3 cases in patients with the former papillotomies. Twenty-one patients underwent one or a few further endoscopic interventions for the arrest of bleeding; surgical treatment was required in two cases. As the result of the delayed bleeding despite the active endoscopic interventions 1 patient with pronounced bilirubinemia, purulent cholangitis with the underlying hepatic cirrhosis of class C according to the Child-Pugh score died. The material for the morphological examination was represented by 144 autopsy observations both with the gallstone disease and without it. For the pathogistological examination after the standard paraffin embedding the graded cross-sections of the papilla on 6 levels were prepared, 3 per each stained with Hematoxiline and Eosine. The morphometry was performed with the use of the screw eyepiece micrometer MOB-1 15 \times . The data was statistically processed with the use of the MS Excel-XP tools.

FINDINGS OF THE STUDY AND DISCUSSION

The major extra duodenal arteries the branches of which supply with blood the terminal portion of the choledoch duct and BSDK are located in the angle between the duct and colonic wall. The branches extend from the posterior pancreaticoduodenal arteries and the arcade formed by them building both the anastomosis with the anterior arterial arcade and the independent branches to the BSDK. Beside the extra-organ anastomosis between the anterior and posterior arterial arcades the connections of the vessels in the papilla wall mass are permanent. We have found the permanent large arterial trunks that may be relevant in terms of development of the clinically significant bleedings after EPST in the mass of the duodenal submucous layer directly outwards the papilla sphincter. They are laterally-oriented relative to the choledoch duct extending over the papilla "roof". The main laterally-oriented arterial trunks anastomose by means of the skewed and longitudinal branches differing through the variability of their number and forming the arterial plexus in the papilla wall mass. These vessels feature the anatomic and histological peculiarities that are to a certain extent related to the topographic segregation of the arterial circulation and portal vein roots in the pancreaticoduodenal area. The arteries are located on the two basic levels – in the area of the papilla duodenal portion (1-3 mm from its entry) and in the projection of the transverse fold of duodenal mucosa. The distal arteries in the amount of 2-3 are accompanied by veins and freely localize in the loose areolar tissue of the submucous layer. The single proximal arteries are also isolated from the venous basins. The specific feature of the arterial vessel walls on both levels is the small relative thickness due to the absence of the external elastic membrane, fragmentation of the internal elastic membrane, poorly expressed adventitia and relatively small thickness of the middle coat. The ratio of the wall thickness to the luminal diameter (Kernogan index) made the value that is optimal for arteries – 0,12-0,15. The diameters of the distal arteries vary from 30 to 50 μ m, the proximal vessels has a diameter of 90-100 μ m. Poor pronouncement of the elastic muscular structures of the arterial walls as compared to the wall thickness probably determine their weak resistance and contraction properties which predisposes to development of the significant bleedings, especially from the

larger proximal vessels. This may also explain the resistance of the bleedings occurring in them after EPST to the conservative anticoagulation therapy. We assured ourselves of the appropriateness of this statement during the repeated endoscopic interventions for the purpose of hemostasis. In 18 cases there was a bleeding of arterial nature that appeared in the upper wound corner within the next 2-6 hours after the primary intervention.

The venous vessels are topographically isolated from the arteries and form 3 plexuses along the entire papilla length – inside the proper plate of the duodenal mucosa covering the BSDK, inside of the proper plate of the papilla wall, inside of the colonic submucosa layer (external connective-tissue papilla layer). The submucosa venous plexus that is draining the micro-circulatory vessel of the colonic mucosa and BSDK is the most pronounced and important. Its specific feature is the multi-layered location in between the distal and proximal transverse arteries described above. Ones of the largest are also the laterally-oriented venous basins forming 4-5 layers with the skewed and longitudinal anastomosis. The specific features of their structure consist in the wide gaping lumen and weak maturity of the wall muscular elements. Unlike the arteries located to the outside of the papilla sphincter muscular elements, certain portion of veins occupies the intermediate position between the colonic submucosa layer and the proper plate of the papilla mucosa thus penetrating into the sphincter mass.

The diameter of the largest veins increases from the distal level of the venous plexus to the proximal one from 100 to 250-300 μm .

The axially-oriented veins connected transversally with the veins in the BSDK “roof” area are located laterally on both sides of the papilla. The wall of the distal veins has the least developed muscular elements, partially represented by only 1-2 layers of the oblique and transverse smooth muscle cells. Both in the distal and proximal veins the adventitial structures are not pronounced and the walls are directly connected with the adjacent connective-tissue and muscular elements. These peculiarities of the venous vessels reflect their significant drain load which is in line with the primarily transport kind of the structure of the papilla wall arteries. Besides, the close connection with the connective-tissue and muscular structures of the papilla wall against the poorly developed proper muscular elements may be the basis of the interaction thereof in order to ensure the venous drainage, and on the other hand, for the vein engagement in the valve function of the papilla mucosa by means of changing the blood filling thereof. This assumption was confirmed by the follow-up morphological examination of the papillotomy area (after 9 months).

The blood vessels with the diameter of 0,2-0,3 mm inside of the papillotomy channel tissues with the deformed sclerosis walls, wide gaping lumens. Moreover, our clinical studies show that as the result of fibrotic changes the “drawing” of the oral corner of the papillotomy cut upwards with its getting closer to the transverse fold sometimes going under it. With account for the location in the transverse fold projection of the large intramural arteries that we have characterized above the post-papillotomy fibrotic changes and the related changes of the structural topography in the area of the ducts entrance into the duodenum significantly increase the risk of bleeding after the repeated papillotomies as compared to the primary EPST

SUMMARY

In our opinion, the described peculiarities of the location, structure and interrelations of the intramural BSDK vessels with its stroma are relevant to the probability of the bleeding occurrence in the course of the primary interventions involving papilla. Besides, the changes in the structure of the papilla wall tissues, dynamics of the inflammation progression as the result of the thermal and mechanical injury during EPST and post-inflammatory sclerosis may affect the blood flow behavior, in particular, its hemostatic capabilities. The loss of a part of sphincters as the result of papillotomy is the factor predisposing to the reduction of vasoconstriction, incompletely closed opening of the arterial and venous vessels and therefore to the increase in probability and severity of the post-papillotomy bleedings by the repeated EPST. This situation appears to be increasingly threatening against the coagulation failures with underlying pronounced obstructive jaundice. These assumptions were confirmed during the further analysis of dynamics of the reparative processes in the BSDK wall within different periods after the primary and repeated interventions.

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