

ASSOCIATING LIVER PARTITION AND PORTAL VEIN LIGATION FOR STAGED HEPATECTOMY (ALPPS): A NEW APPROACH IN LIVER RESECTIONS

Ligadura da veia porta associada à transecção para hepatectomia em dois estágios (ALPPS): uma nova abordagem nas ressecções hepáticas

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ABSTRACT – Background - Postoperative liver failure consequent to insufficiency of remnant liver is a feared complication in patients who underwent extensive liver resections. The associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) is a new approach for patient which tumor is previously considered unresectable. **Aim** – To present ALPPS as an innovative surgical technique of two-staged hepatectomy for the treatment of patients with marginally resectable or initially nonresectable primary and metastatic liver tumors. **Technique** – The procedure is performed in two steps. The first consists on ligation of the right portal vein branch. Subsequently, total or nearly total parenchyma dissection along the falciform ligament is performed, including the middle hepatic vein. A plastic bag is used to cover the right extended lobe, and the abdomen is drained and closed. The second one is performed after a computer tomography, six to 12 days interval. After laparotomy, the plastic bag is removed. The right artery, right bile duct and the right hepatic vein are divided. The extended right lobe is removed. Drain is placed at the resection surface, and the abdomen is closed. **Conclusion** – The associating of liver partition and portal vein ligation can enable curative resection of liver metastasis in patients with lesions previously considered unresectable.

HEADINGS – Hepatectomy. Metastasis. Technique.

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DESCRITORES - Hepatectomia. Metástase. Técnica.

RESUMO – Racional – Insuficiência hepática pós-operatória devido a remanescente hepático pequeno tem sido complicação temida em pacientes que são submetidos à ressecção hepática extensa. A associação da transecção hepática e ligadura da veia porta para hepatectomia estagiada (ALPPS) é uma nova abordagem para pacientes em que o tumor é previamente considerado irresssecável. **Objetivo** – Apresentar a técnica ALPPS como procedimento novo de hepatectomia em dois estágios com ligadura da veia porta e transecção hepática mantendo o fígado in situ para o tratamento de pacientes com tumores primários ou metastáticos marginalmente ressecáveis. **Técnica** – O procedimento é realizado em dois tempos. O primeiro consiste na ligadura do ramo direito da veia porta. Em seguida é realizada a transecção total ou quase total do parênquima hepático acompanhando o ligamento falciforme, incluindo a veia hepática média. Um saco plástico é utilizado para recobrir o fígado que será retirado; o abdome é drenado e realizada a síntese da parede por planos. O segundo tempo é feito após seis a 12 dias de intervalo com realização de tomografia computadorizada de abdome. Na laparotomia o saco plástico é removido. Os ramos direito da artéria hepática, ducto hepático e veia hepática são ligados e o lobo hepático direito é removido. Um dreno é posicionado na superfície de ressecção e a síntese da parede abdominal é realizada. **Conclusão** - ALPPS permite ressecção curativa de lesões hepáticas em pacientes com doença considerada previamente irresssecável.

INTRODUCTION

Surgical resection is the only potentially curative therapeutic option in patients with primary or metastatic hepatic malignancies. One very important limiting factor for performing major liver resections is the remaining liver volume, referred to as future liver remnant. Postoperative liver failure consequent to insufficiency of remnant liver is a feared complication in patients who

underwent extensive liver resections^{2,7}.

The estimated future liver remnant volume to prevent postoperative liver failure should be at least 25% of total liver volume in healthy livers. For patients with hepatic dysfunction or earlier liver injury due to chemotherapy, a higher future liver remnant (approximately 40%) is recommended^{2,7}.

Some strategies have been developed to increase resectability in patients undergoing major hepatic resection. One of them is a two-staged hepatic resection and the another is portal vein occlusion. This occlusion can be done through embolization by radiology or surgical portal vein ligation. This approach is able to induce atrophy of the tumor-bearing lobe with subsequent hypertrophy in the contralateral lobe by diverting the portal venous flow. Portal occlusion increases the future liver remnant up to 40% within three to eight weeks. However, its sufficient hypertrophy is not always achieved, and there is still concern about the potential for simultaneous and faster growth of the tumor during the period prior to resection^{2,6}.

The aim of this study is to present an innovative surgical technique of two-staged hepatectomy with initial portal vein ligation and in situ splitting for the treatment of patients with marginally resectable or initially nonresectable primary and metastatic liver tumors.

TECHNIQUE

The procedure is performed in two steps.

The first consists of exploratory laparotomy, assessment of resectability with intraoperative ultrasound and positioning the tumor in relation with vessels. Small tumors in left lateral lobe can be resected. The liver is mobilized by dissecting the ligaments. The right liver lobe is completely mobilized from the caval vein. Hilar structures are exposed close to their particular bifurcations, approaching from the right part of the hepatoduodenal ligament. After the right portal vein branch is identified, it is divided. Portal, arterial and biliary segment IV branches is identified and divided. Subsequently, total or nearly total parenchymal dissection along the falciform ligament is performed using bipolar coagulation irrigated with saline solution. The middle hepatic vein is divided during the parenchymal dissection, preserving the pedicle to the left lobe. After in situ splitting, the right extended lobe is covered in a plastic bag to prevent adhesions, and the abdomen is drained and closed (Figure 1).

The second step is performed after an interval of 6-12 days. A computed tomography is performed

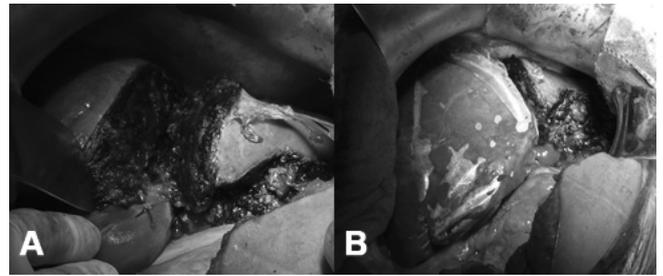


FIGURE 1 - A - Transection of the liver; B - protection with sterile bag and the procedure is completed by relaparotomy. The plastic covering is removed from the right-extended lobe. The right artery, right bile duct and the right hepatic vein are ligated. In addition, remaining parenchymal bridges of liver tissue with vena cava and diaphragm is divided, if present. The liver resection is completed (Figure 2). The left lateral lobe is then fixed to the remnant falciform ligament. Finally, a drain is placed at the resection surface, and the abdomen is closed.



FIGURE 2 - Final aspect of the surgical procedure

Was performed the ALPPS technique in a 30-year old female with multiple colorectal liver metastasis. The patient underwent a left colectomy due to adenocarcinoma and chemotherapy six months before. The computed tomography revealed multiples liver metastasis.

The patient had normal liver function and the first step was performed without complications and the patient stayed in intensive care unit overnight. The second step was performed after a computed tomography that showed a sufficient volume of the left lateral liver lobe (segments II and III). Blood transfusion was not required. The liver function was normal by post-operative day seven and the patient was discharged by day nine without complications and was followed-up for four months without recurrent disease.

DISCUSSION

The only chance to obtain long-term survival in patients with hepatic tumor or metastasis from other primary cancers is complete tumor resection in the liver. The remaining liver volume is still one important limiting factor to perform major liver resections. Portal vein embolization or ligation are able to induce liver hypertrophy of 25-40% after three to eight weeks. However, the embolization of segment IV branch requires optimal access, frequently not available in many centers. In some patients sufficient hypertrophy of the future liver remnant is not always achieved and there is still concern about the potential for simultaneous tumor progression after portal vein embolization during the period prior to resection^{1,6}.

In ALPPS approach, the portal vein ligation associated with in situ splitting is able to induce enormously accelerated hypertrophy. The neovascularization and persistence of interlobar perfusion are prevented by performing parenchymal dissection and complete devascularization of segment IV. The nearly total parenchymal dissection induced a median hypertrophy of 74%, which is markedly above the range that can be achieved by portal vein ligation or portal vein embolization alone^{1,3,6}.

The median time interval to have hypertrophic effect is nine days. De Santibanes observed a rapid growth of the future liver remnant up to 83% in only six days. In contrast, hypertrophy using portal vein ligation or portal vein embolization is generally after four weeks and achieved a much lower degree of hypertrophy³.

An important point to promote accelerated hypertrophy must be attributed to the in situ splitting procedure. This technique leads to complete devascularization of segment IV and also prevents formation of vascular collaterals between the left lateral and the right extended liver lobe. This combination of portal vein ligation and in situ splitting is able to induce a much stronger stimulus leading to rapid and marked hypertrophy of the left lateral lobe. The in situ splitting causes disruption on intrahepatic portal collaterals leading to a portal flow deprivation to the excluded segments and redistribution of hepatotrophic factors^{1,3,6}.

In spite of the excluded liver does not have any portal flow, it acts as an auxiliary liver that contributes to the total liver function until the contralateral lobe has grown enough to tolerate the physiological function like a normal liver^{1,3,6}.

The morbidity after this extended liver

resection depends on the liver and patient condition at the time of surgery. The extent of resection and underlying disease are also important. This patient did not experience any complications. Schnitzbauer et al observed 64% of complications. Fifty percent were classified as grade I or II. ALPPS is a safe procedure, but technically complex and should be undertaken by experienced hepatobiliary surgeons^{5,6}.

The use of a plastic bag around the liver, as in this patient, to avoid adhesions, is another point of interest and concern. Wrapping of the whole right lobe cannot be recommended because of the possible undrained fluid collections within the bag. Bioactive sealants have been applied to the cut surface to prevent adhesions, with the advantage that they do not have to be removed. Machado et al reported ALPPS performed totally by laparoscopy with minor adhesions^{3,5,6}.

This and other cases should stimulate further basic scientific research to answer some questions related to liver regeneration, tumor molecular biology and biochemical analysis. These studies can have the opportunity in the future to explain these unsolved questions nowadays. The adequate selection of the patient who might benefit from this approach must be taken into account. In this and others studies ALPPS was able to induce much more pronounced and rapid tissue increase in future liver remnant for patients with marginally resectable liver tumors^{1,3,5,6}.

In conclusion, this approach represents a novel technique in modern oncological liver surgery.

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