

# Monosegment ALPPS for bilateral colorectal liver metastasis - One is enough

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Associated liver partition and portal vein ligation for staged hepatectomy – ALPPS – procedure emerged as an alternative to treat patients needing extensive hepatic resections, but with a small future liver remnant. Initially described using the left lateral segments as liver remnant, ALPPS has been adapted to leave as remainder only one segment. Describe a case of a patient with bilobar colorectal liver metastasis submitted to segment 4-1 ALPPS. A 63-year-old man, previously submitted to transversostomy, due to a left colon stenosing adenocarcinoma, associated to bilobar liver metastasis, was referred for our evaluation, after receiving a FOLFOX based chemotherapy. Due to the large load of tumor within the liver, we opted to perform a segment 4-1 ALPPS, which was carried out with an interval of 21 days between first and second stages. The liver remnant increased from 250 cc to 694 cc (18% to 48% of standard liver volume). The patient was discharged 15 days after second stage surgery and was subjected to left colectomy after five months. He is disease-free ten months after liver surgery. Monosegment ALPPS is a challenging, but feasible procedure, that should be criteriously indicated in selected patients and performed by a hepatobiliary surgery team with experience in complex major hepatectomies. ([Ann Hepatobiliary Pancreat Surg 2020;24:522-525](#))

**Key Words:** Liver; Surgery; Metastasis; Colorectal neoplasms; Surgical oncology

## INTRODUCTION

Associated liver partition and portal vein ligation for staged hepatectomy (ALPPS) procedure emerged as an alternative treatment for patients with a large load of tumor within the liver and a small future liver remnant (FLR).<sup>1</sup> Despite the initial critics and high morbi-mortality worldwide,<sup>1</sup> ALPPS passed through the test of time, and is still been performed, but the indications are more restricted nowadays.<sup>2,3</sup> Initially described using the left lateral segments as FLR,<sup>1</sup> ALPPS has been adapted in selected cases, using only one segment as FLR.<sup>4-11</sup> Herein, we describe a case of a patient with bilobar colorectal liver metastasis (CRLM) submitted to segment 4-1 ALPPS with liver-first approach.

## CASE

A 63-year-old man (height: 169 cm; weight 70 kg; BMI 24.5) was referred for our evaluation seven months after being submitted to an urgent transversostomy, due to a left colon stenosing adenocarcinoma (previously confirmed by biopsy), causing intestinal obstruction. After surgery, the patient was staged and abdominal CT scan revealed multiple liver implants in almost all hepatic segments (Fig. 1). No extra hepatic implants were identified. CEA value at this time was 196 ng/dl. He received six cycles of FOLFOX based chemotherapy and was restaged. CEA value dropped to 1.8 ng/dl. A MRI scan showed that the liver tumors reduced in volume, yet left lateral section and right liver still compromised. The caudate lobe was free of disease and segment 4 had two peripheral lesions that could be cleared by edge resection (Fig. 1). Volume of segments 4+1 was estimated at 250 cc, corresponding to

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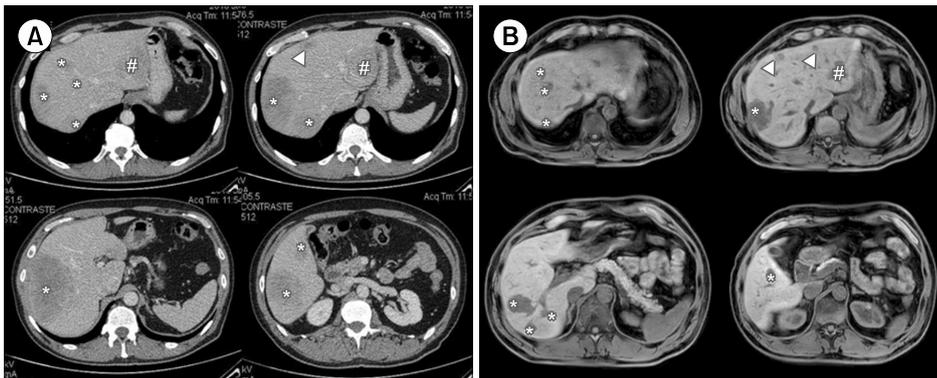
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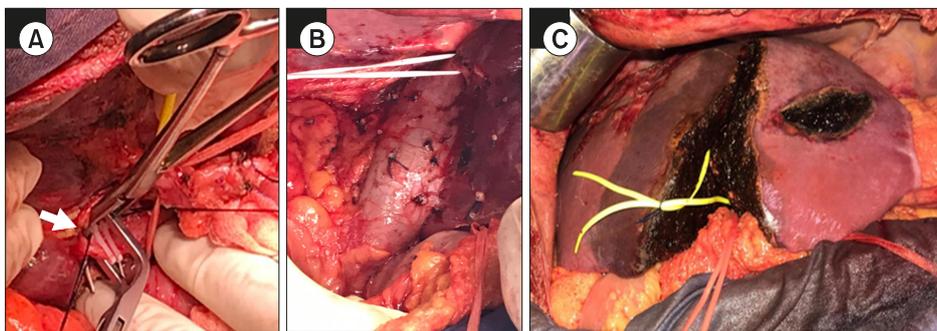
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**Fig. 1.** (A) CT scan before chemotherapy; (B) MRI scan after chemotherapy; in both images, you can see lesions in the right liver (\*), in the left lateral section (#) and in segment 4 (arrowhead).

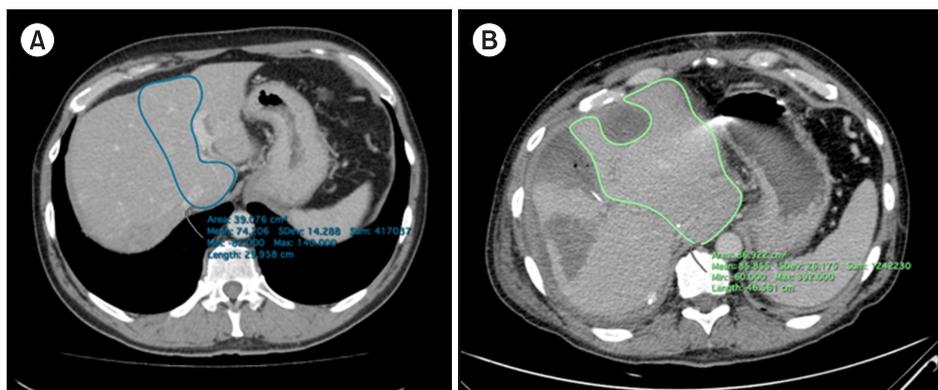


**Fig. 2.** (A) Right portal vein was ligated with hem-o-lok clips (arrow); (B) right hepatic vein encircled with white tape; (C) final aspect of the liver after 1<sup>st</sup> stage surgery; right hilar plate encircled with yellow tape; right hepatic artery (not seen) encircled with red tape.

18% of standard liver volume (SLV) and 0.36 FLR/BW ratio. After multidisciplinary team discussion and based on our recent experience with a similar case, we opted to perform a liver-first approach with a segment 4-1 ALPPS.

Stage 1 surgery was carried out under open technique with a J-shape incision. First, we performed the left lateral sectionectomy with intra-hepatic ligation and division of vascular pedicles with automatic stapler, associated to segment 4 clearing of lesions. Then, we proceeded with parenchyma transection using hanging maneuver, ultrasonic dissector/aspirator and bipolar sealant device. Hepatic pedicle was taped, but Pringle maneuver was not performed during hepatotomy. The right portal vein was ligated with hem-o-lok clips and divided. Vessel loops were placed around the right hilar plate, right hepatic artery (RHA) and the right hepatic vein (RHV) (Fig. 2). Cholecystectomy was performed and saline and air was injected through the cystic duct to look for bile leakage points. Drains were positioned in the right subphrenic space and in the transection space. The procedure lasted 350 minutes and the patient received no blood transfusion. He stayed in ICU for three days. On the 6th post-operative day (POD) patient presented cough, fever, elevation of white blood cells and C reactive protein. CT scan re-

vealed bilateral pneumonia and Piperacilin with Tazobactam was initiated. Owing to the lung infection and antibiotic treatment, the 2nd stage was carried out only 21 days after de first surgery. CT scan from the 18th POD showed an expressive growth of the FLR to 694 cc (an increase of 277%), corresponding to 48% of SLV and 0.98 FLR/BW ratio (Fig. 3). The 2nd stage was technically difficult due to inflammation process involving the right hilar plate, which was ligated and divided with automatic stapler with extremely care to avoid bleeding. RHA and RHV were ligated with polypropylene suture and divided. Stage 2 lasted 270 minutes and patient received one blood unit transfusion. He stayed for five days in ICU after 2nd surgery and developed a grade A liver dysfunction after operation. He also developed a large right-sided pleural effusion, which was drained by thoracocentesis, and a low debit biliary fistula, treated conservatively. The patient was discharged on the 15th POD, after 2nd stage surgery, completing 36 days of hospital stay. He was subjected to left colectomy after five months and is disease-free ten months after liver surgery.



**Fig. 3.** (A) Segment 4 of the liver before ALPPS; (B) segment 4 of the liver after 1<sup>st</sup> stage surgery, showing expressive hypertrophy.

## DISCUSSION

Since the initial series published by Schnitzbauer et al.,<sup>1</sup> ALPPS approach has been exhaustively discussed and passed through many “probations”. Even though, there are reports of ALPPS in patients with cholangiocarcinoma<sup>12</sup> and hepatocellular carcinoma,<sup>13</sup> better outcomes have been achieved for cases of bilobar CRLM, especially in patients under 60 years of age.<sup>2</sup> Recent papers emphasize the role of ALPPS as a salvage procedure for patients that fail to achieve adequate hypertrophy of the FLR with percutaneous portal embolization.<sup>3</sup> Originally performed using the left lateral section as FLR, ALPPS has been modified to use only one segment as FLR. After reading the paper by de Santibañes<sup>4</sup> describing the segment 4-1 ALPPS, we performed our first monosegment ALPPS in 2015 with excellent result.<sup>5</sup> So far, we could find 19 reports of monosegment ALPPS in literature,<sup>4-11</sup> most of them using segment 4 as FLR, associated or not with segment 1. Even though, the majority of cases correspond to adult patients with CRLM, as our case described here, we found two interesting reports of segment 6 ALPPS, one in a 3-year-old child with hepatoblastoma,<sup>10</sup> and other in an adult with intra-hepatic cholangiocarcinoma involving the three hepatic veins.<sup>8</sup>

Different from our first case, which patient had bulky lesions involving the left lateral section and right liver, the patient described here had smaller lesions spread out through the liver parenchyma, involving the pedicles from segments 2 and 3 and all segments from right liver, similarly to the 12 cases reported previously in the review paper by Schadde et al.<sup>11</sup> After 1st stage, we could observe an expressive hypertrophy of the FLR of 277%, which is

the higher value among all cases of monosegment ALPPS, that we found in literature. Even though, we needed to wait for 21 days to perform the 2nd stage, due to the pneumonia, this great hypertrophy was already been noticed on the 6th POD, during the CT scan of the thorax. Like our first case, this patient experienced a grade A liver dysfunction (according to ISGLS<sup>14</sup>) after stage 2. This complication was also observed in other cases described before, with no further implications. We believe that out-flow congestion may play a role in this dysfunction. The patient also developed a pleural effusion, drained by thoracocentesis, corresponding to Clavien-Dindo grade IIIA complication. Regarding the disease-free survival, this patient had no recurrence after 10 months and is still under surveillance. Our first patient had recurrence of disease in the right adrenal and lung, which were resected 36 and 39 months after surgery, respectively. She is still alive, 57 months after ALPPS. In the cases found in literature, considering patients with CRLM, the disease-free survival and overall survival for monosegment ALPPS are 14.6 and 20.1 months, respectively. Those short time results could be explained by the aggressiveness of disease affecting those patients and that is why they were submitted to such complex procedure. On the other hand, without surgery, those results would have been probably worse.

## CONCLUSION

The ALPPS approach has become a reality and an important tool in the arsenal of the hepatobiliary surgeon. Leave only one hepatic segment, as in monosegment ALPPS, is a challenging, but feasible and safe procedure, that should be criteriously indicated as part of the onco-

logical treatment of selected patients. It should be performed by a hepatobiliary team with experience in complex major hepatectomies, preferably for patients with CRLM.

## CONFLICT OF INTEREST

There are no conflicts of interest.

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## AUTHOR CONTRIBUTIONS

Conceptualization: KS. Data curation: KS, RF. Formal analysis: KS, RF, GS, TA. Methodology: KS, RF, GS, TA. Project administration: KS. Visualization: KS. Writing - original draft: KS, RF. Writing - review & editing: KS, RF, TA.

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