

CASE REPORT

Experience of associated liver partition and portal vein ligation for staged hepatectomy as first published case report in Saudi Arabia

Shaikhah Aljumaiah | Leenah Alarfaj | Ahmad I. Almahozi  | Mahmoud Tabbal  | Mohammed S. Alqahtani 

Hepatobiliary Surgery Section, Department of Surgery, King Fahd Specialist Hospital Dammam, Dammam, Saudi Arabia

Correspondence

Mohammed S. Alqahtani, King Fahad Specialist Hospital Dammam, Dammam, Saudi Arabia.

Email: mohammedsaad.qahtani@kfsh.med.sa

Key Clinical Message

This case is the first published associated liver partition and portal vein ligation for staged hepatectomy procedure done successfully in Saudi Arabia, with excellent hypertrophic response to the liver remnant. This is a milestone in liver resection techniques in the country and the region.

KEYWORDS

liver metastasis, liver remnant, liver resection, portal vein ligation, staged hepatectomy

1 | INTRODUCTION

The dilemma of liver metastases resectability is a well-addressed challenging problem to hepatobiliary surgeons. Large liver tumors may require extensive resection, which could result in detrimental postoperative complications, including liver failure.¹ Several methods of portal vein modulation have been described in order to increase the size of the future liver remnant (FLR), portal vein embolization, ligation, or staged hepatectomy. Out of these methods, associated liver partition and portal vein ligation for staged hepatectomy (ALPPS) has shown to have more rapid volume increase than other techniques.²

The procedure includes liver partitioning with portal vein ligation, followed by a second procedure within 1-2 weeks, in which the diseased, deportalized part of the liver is removed.³ In the first operation, the hepatic artery blood flow to the diseased hemi-liver is preserved. This permits the diseased part of the liver to maintain its synthetic and metabolic functions, serving as a vital accessory liver that aid in the development of the FLR.⁴⁻⁶ The ALPPS has been reported to allow FLR growth of 40%-160% within 6-9 days.⁷

We present a case of a patient who underwent two-stage hepatectomy with ALPPS for multiple liver metastases of colon cancer.

2 | CASE PRESENTATION

A 63-year-old man presented with a positive fecal occult blood test was diagnosed with sigmoid cancer by colonoscopy. He is diabetic on oral hypoglycemic medications. CT showed circumferential mural thickening along the sigmoid colon without evidence of obstruction associated with small adjacent lymph node. The liver demonstrated two right liver lobe masses one in segment 4a measuring 3.2 × 4.4 cm, which was involving the middle hepatic vein at its origin, and the other lesion in segment 8 measuring 5.3 × 3 cm, invading the right anterior portal vein and sitting 7 mm away from the right hepatic vein. The patient was pathologically diagnosed with moderately invasive differentiated adenocarcinoma, classified as T3N1 in the TNM system.

The patient was discussed in the tumor board, and it was decided to start him with neoadjuvant chemotherapy and apply colonic stent to the primary lesion. The patient was

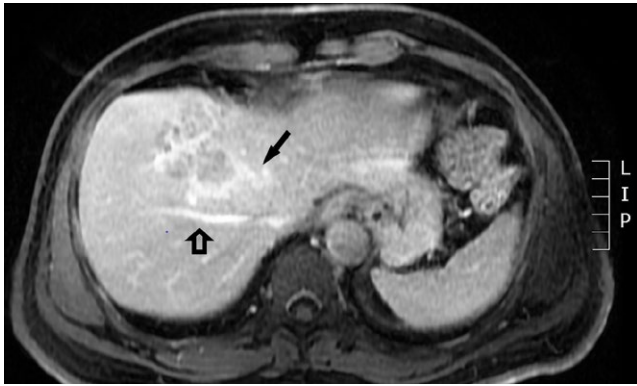


FIGURE 1 Post-chemo liver mass, relation to right hepatic vein (hollow arrow) and middle hepatic vein (black arrow)

started on FOLFOX and cetuximab. After 15 cycles of chemotherapy, the CT showed minimal regression in the primary lesion and partial response in the liver metastases (Figures 1 and 2). Associated liver partition and portal vein ligation for staged hepatectomy (ALPPS) was decided to be performed to the liver metastases six weeks after the last chemotherapy cycle. Preoperative liver function tests were as follows: total bilirubin: 8.28 $\mu\text{mol/L}$, alkaline phosphatase (ALP): 99 IU/L, alanine aminotransferase (ALT): 22 IU/L, aspartate aminotransferase (AST): 23 IU/L, albumin: 37 g/L total protein: 71 g/L.

During the first stage of the ALPPS, right subcostal incision was made and extended to the midline forming J-shape incision. Both liver lobes were mobilized by dividing right and left coronary ligament. Standard cholecystectomy was done. Intraoperative ultrasound was done which showed two lesions in segments 4a & 8; no other lesions were identified. The right hepatic artery was identified and looped. Right portal vein was identified and ligated using vascular stapler. Right and middle hepatic veins were looped separately.

Pringle maneuver was performed, and the liver parenchyma was transected between medial and lateral aspect of the left lobe. Hemostasis was secured, and skin was closed

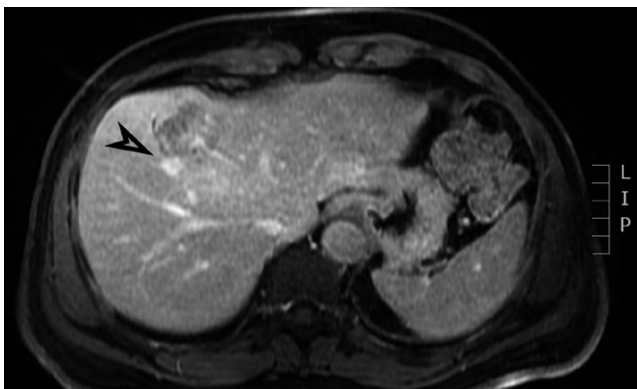


FIGURE 2 Post-chemo liver mass, relation to right anterior portal vein (arrow)



FIGURE 3 Pre-ALPPS left lateral segment (29% of total liver volume)

using skin stapler. Estimated operation time was 240 minutes, and blood loss was 650 mL.

On the 1st postoperative day, the patient was vitally stable, looking well, tolerating full liquid diet. Day 2 postoperative, the patient was ambulated, tolerating soft diet and passing bowel motions. Liver enzymes and bilirubin peaked during the first and second postoperative days with total bilirubin: 179 $\mu\text{mol/L}$, AST at 609 IU/L, ALT at 1144 IU/L, ALP: 403 IU/L, albumin: 27g/L which all started to show gradual improvement afterward. CT volumetry on day 9 post-portal vein ligation showed sufficient FLR increase from 292 mL, 29% of total liver volume (around 1415 mL; Figure 3) to 451 mL, 45% of total liver volume (around 1524 mL; Figure 4). Patient laboratories regained normal range. The FLR was considered to be sufficient to proceed with second stage of ALPPS.

During the ALPPS stage II operation, the previous incision was opened. Exploration of the abdomen showed adhesions of the omentum over the previous liver transection site which was lysed under direct visualization using blunt and sharp dissection. The right hepatic artery was transfixed and divided. The right hepatic duct, right hepatic vein, and middle hepatic vein were stapled using Endo GIA™. The right liver lobe was removed and sent to



FIGURE 4 Post-ALPPS future liver remnant (45% of total liver volume)

pathology. Hemostasis was secured. The skin was closed using clips. Estimated operation time was 60 minutes, and blood loss was 130 mL.

Day 2 postoperative of the second stage, the patient vital signs were normal, and his laboratories showed increased in the liver functions tests as follows: total bilirubin: 73.4 $\mu\text{mol/L}$, AST at 185 IU/L, ALT at 178 IU/L, ALP: 124 IU/L, albumin: 31g/L, other laboratories were all normal. All liver function tests started to show gradual improvement over time. The patient was discharged home on day 14 postoperative. Both stages of the operation went smoothly with no intra- or postoperative complications.

The patient was followed up in the hepatobiliary surgery clinic 10 days, 1 month, and 3 months after discharge. The patient is doing well. His liver function test is all within normal. CT was done which showed no newly developed liver lesion after ALPPS.

3 | DISCUSSION

Colorectal cancer is the most common cancer in Saudi Arabia,⁸ and according to one study, the liver is the most common site for metastasis.⁹ Achieving adequate surgical margins while avoiding postoperative liver decompensation and failure remains a challenge. The use of ALPPS in inducing rapid liver hypertrophy is perceived by many groups as a promising method in reducing posthepatectomy liver failure. The literature has shown that the future liver remnant can proliferate by rapid rates, reaching up to 22% per day.¹⁰ Data from the International ALPPS Registry indicate that ALPPS is most commonly used in treating colorectal liver metastases¹¹ and remains as the only potential curative method in some cases. As mentioned, this is the first report in Saudi Arabia describing a patient who underwent ALPPS.

Several procedures have been proposed to induce liver hypertrophy, including portal vein embolization, portal vein ligation, and ALPPS.² For our patient, ALPPS provided an increase in the future liver remnant by about 54%, in a period of 9 days. This is comparable to what is reported in the literature, even though some studies have reported higher increase in the future liver remnant, reaching up to 93% in the same period.²

Despite the great enthusiasm, the procedure remains relatively new, with little evidence on long-term results. Several complications have been reported, most commonly biliary fistula and infection.¹¹ Mortality and morbidity rates remain high. It is estimated that the in-hospital mortality rate can reach up to 12%, and morbidity rate up to 68%.² Our patient had recovered liver function within 3 weeks after surgery. Further studies are required to identify optimal candidates for the surgery.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHOR CONTRIBUTION

All authors contributed to the conception and final approval of the paper. SA: wrote the manuscript. LA and AM: collected the data. MT and MA: reviewed the final manuscript.

ORCID

Ahmad I. Almahozi  <https://orcid.org/0000-0002-0391-6124>

Mahmoud Tabbal  <https://orcid.org/0000-0002-4764-1601>

Mohammed S. Alqahtani  <https://orcid.org/0000-0002-4122-4954>

REFERENCES

- Clavien P-A, Petrowsky H, DeOliveira ML, Graf R. Strategies for safer liver surgery and partial liver transplantation. *N Engl J Med*. 2007;356(15):1545-1559.
- Cai Y-L, Song P-P, Tang W, Cheng N-S. An updated systematic review of the evolution of ALPPS and evaluation of its advantages and disadvantages in accordance with current evidence. *Medicine (Baltimore)*. 2016;95(24):e3941.
- Tanaka K, Matsuo K, Murakami T, et al. Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS): Short-term outcome, functional changes in the future liver remnant, and tumor growth activity. *Eur J Surg Oncol*. 2015;41(4):506-512.
- Zerial M, Lorenzin D, Risaliti A, Zuiani C, Girometti R. Abdominal cross-sectional imaging of the associating liver partition and portal vein ligation for staged hepatectomy procedure. *World J Hepatol*. 2017;9(16):733.
- Sala S, Ardiles V, Ulla M, Alvarez F, Pekolj J, de Santibañes E. Our initial experience with ALPPS technique: encouraging results. *Updates Surg*. 2012;64(3):167-172.
- Torres O, Moraes-Junior J, Lima e Lima NC, Moraes AM. Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS): a new approach in liver resections. *Arq Bras Cir Dig*. 25(4), 290-292.
- Schnitzbauer AA, Lang SA, Goessmann H, et al. Right portal vein ligation combined with in situ splitting induces rapid left lateral liver lobe hypertrophy enabling 2-staged extended right hepatic resection in small-for-size settings. *Ann Surg*. 2012;255(3):405-414.
- Alsanea N, Abduljabbar AS, Alhomoud S, Ashari LH, Hibbert D, Bazarbashi S. Colorectal cancer in Saudi Arabia: incidence, survival, demographics and implications for national policies. *Ann Saudi Med*. 2015;35(3):196-202.
- Hassanain M, Al-alem F, Simoneau E, et al. Colorectal cancer liver metastasis trends in the kingdom of Saudi Arabia. *Saudi J Gastroenterol*. 2016;22(5):370-374.
- Oldhafer KJ, Donati M, Jenner RM, Stang A, Stavrou GA. ALPPS for patients with colorectal liver metastases:

effective liver hypertrophy, but early tumor recurrence. *World J Surg.* 2014;38(6):1504-1509.

11. Abdul Mazid M, Zhen Wan F, Shahinur Akter G, Hui Ye Z, Chuan Zhao H, Ping Geng X. A case report of ALPPS for giant hepatic cancer complicated with perioperative acute renal injury. *J Biol Med Sci.* 2017;1:101. <https://www.omicsonline.org/open-access/a-case-report-of-alpps-for-giant-hepatic-cancer-complicated-withperioperative-acute-renal-injury.pdf>. Accessed August 13, 2018.

How to cite this article: Aljumaiah S, Alarfaj L, Almahozi AI, Tabbal M, Alqahtani MS. Experience of associated liver partition and portal vein ligation for staged hepatectomy as first published case report in Saudi Arabia. *Clin Case Rep.* 2019;7:1083–1086. <https://doi.org/10.1002/ccr3.2146>