Ante-situm Liver Resection for Giant Hepatic Tumour – Case Report and Review of Literature

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Rezumat

Rezecția hepatică ante-situm pentru o tumoră hepatică gigantă – prezentare de caz și review al literaturii

Chirurgia hepatică ex-situ se referă la rezecțiile hepatice complexe care implică excluderea vasculară hepatică și o perioadă de ischemie caldă de peste 90 de minute, ceea ce permite rezecția hepatică și reconstrucția vasculară la pacienții cu tumori hepatice gigante sau cu o abordare dificilă. Rezecțiile hepatice ante-situm, altfel numite rezecții ex-situ in-vivo, se realizează prin externalizarea ficatului în afara cavității abdominale prin secționarea venelor suprahepatice ("ex situ") lăsând pediculul hepatic intact (in vivo). Prezentăm cazul unui pacient în vârstă de 36 de ani diagnosticat la examenul RMN cu o tumoră hepatică gigantă în hemifuniculul stâng. O hepatectomie "ex-situ in-vivo" stângă a fost efectuată prin legarea și secționarea venelor hepatice stângi și medii, clamparea și secționarea venei hepatice drepte, manevra Pringle, externalizarea ficatului, urmată de rezecția tumorii și reimplantarea venei hepatice drepte. Timpul scurt de ischemie caldă (rezecția hepatică și reimplantarea hepatică - 30 de minute) ne-a permis efectuarea procedurii fără instalarea unui șunt veno-venos sau porto-caval utilizat altfel în toate procedurile ex-situ descrise în literatura revizuită în această prezentare. Rezecția hepatică ante-situm este o procedură viabilă pentru tumorile hepatice gigante în cazuri foarte atent selectate. Ea facilitează rezecția tumorilor hepatice altfel considerate inoperabile, extinzând indicațiile de tratament chirurgical.

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Cuvinte cheie: chirurgie hepatică, ex-situ in-vivo, ante-situm, hemangiom gigant

Abstract

Ex-situ liver surgery refers to complex liver resections involving hepatic vascular exclusion and a warm ischemia time (WIT) of more than 90 minutes that allows liver resection and vascular reconstruction in patients with giant liver tumours with a difficult approach. Ante-situm liver resections, otherwise called “ex-situ in-vivo” resections is achieved through externalization of the liver outside of the abdominal cavity by clamping and sectioning of the efferent pedicles (supra-hepatic veins) (“ex situ”) without cutting the afferent vascular pedicle (“in vivo”), thus leaving the hepatic pedicle intact. We present a case report of a 36 yo male patient diagnosed by MRI scan with giant liver tumor in the left hemiliver. A left “ex-situ in-vivo” hepatectomy was performed by dissecting and ligating the left and middle hepatic veins, clamping and sectioning the right hepatic vein, Pringle maneuver, externalization of the liver followed by the tumor resection and right hepatic vein reimplantation. The short warm ischemia time (hepatic resection + liver reimplantation - 30 minutes) allowed us to perform the procedure without installing a veno-venous or porto-caval shunt otherwise used in all of ex-situ procedures described in the literature reviewed in this presentation. Ex-situ liver resection is a viable procedure for giant liver tumours in highly selected cases. It facilitates resection of large liver tumours that would be otherwise unresectable, extending the indications of surgical treatment.

Key words: ante-situm, liver surgery, ex-situ in-vivo, giant liver hemangioma

Background

Ex-situ liver surgery refers to complex liver resections involving hepatic vascular exclusion and a warm ischemia time (WIT) of more than 90 minutes that allows liver resection and vascular reconstruction in patients with giant liver tumours with a difficult approach [in close proximity of the inferior vena cava (IVC)], or tumours involving the vena cava or supra-hepatic veins considered to be unresectable by conventional surgery techniques (1). The ante-situm, also called “ex situ - in vivo” liver resection, is achieved through externalization of the liver outside of the abdominal cavity by clamping and sectioning of the efferent pedicles (suprahepatic veins) (“ex situ”) without cutting the afferent vascular pedicle (“in vivo”), thus leaving the hepatic pedicle intact (2,3).

Case Report

A 36 –year-old male patient was admitted with right upper quadrant abdominal pain. MRI

scans revealed a giant (20/15/17 cm) tumour in the left lobe of the liver segments 2-4 that compressed both the left and the middle hepatic veins, abutting the retrohepatic IVC on 9 cm of its length (*Fig. 1*). The right hepatic vein was tumour-free. Preoperative liver function

Figure 1. MRI scan showing the giant liver tumor

tests were normal. HCV, HBV, HEV tests were negative.

The total liver volume (TLV) and future remnant liver volume (FRLV) were measured using OsiriX®, a free software offered by the Swiss company Pixmeo SARL (4). A TLV of 3034 cm³ was calculated, compound of 1446 cm³ of FRLV (47.65%) and 1597 (52,35 %) cm³ tumour volume (*Fig. 2*). As the FRLV was above 35% and the liver function was intact, the risk for a postresectional liver failure due to a small-for-size liver remnant was considered to be very low and a decision was made to resect the tumour. A 3D liver model illustrated in *Fig. 3* was created using the same software.

Surgery

After a difficult mobilization of the left hepatic lobe, with dissection and ligation of the left and middle hepatic veins, the surgeon approached the right lobe; dissection of the Spiegelian vessels exposed a traumatic lesion of the right hepatic vein due to an extensive traction during the mobilization. After a careful review of the available surgical options the operator considered that the suturing of the right hepatic vein lesion could lead to a stenosis at this level and to consequent poor liver remnant

venous outflow. Therefore a left ante-situm hepatectomy was performed, by clamping and sectioning the right suprahepatic vein, Pringle manoeuvre of the hepatic pedicle, cross-clamping the supra- and the infrahepatic IVC, and externalization of the liver. This was followed by the ex situ tumour resection and right hepatic vein reimplantation in the IVC at the level of right hepatic vein junction to IVC. (*Figs. 4, 5*)

The relatively short WIT (hepatic resection and liver reimplantation of approximative. 30 minutes) (5) and the urgent and unpredictable decision of performing an ante-situm procedure has allowed us to undertake the procedure without veno-venous or porto-caval shunt or hypothermic liver perfusion. Histopathological examination revealed a hemangioma of the liver.

The patient had no postoperative complications. LFTs normalized on POD 3 and he was discharged on POD 7. On the 8th month follow-up the patient is alive, with no signs of recurrence and has returned to normal life.

Discussion

Pichlmayr was the first one to introduce the concept of ex-situ liver resections in 1988, a

Figure 2. 3D reconstruction of FRLV (left) and tumor volume (right) using OsiriX®

Figure 3. 3D liver volume and tumor reconstruction acquired by OsiriX® lite software

technique of liver ex- and implantation based on liver transplant methods (6). He also explored additional possibilities and a new liver surgery perspective in highly selected and otherwise unresectable liver tumours, referring to methods as in-situ, ante-situm and ex-situ liver surgery.

Hannoun et al. described the “ex-situ in-vivo” liver resection in 1991 with an “intact hepatic pedicle” (7,8) for major hepatic resection with complex vascular reconstruction and with a prolonged ischemia time of 2.3-5h. Liver parenchyma was protected against a long

ischemia time by cold portal perfusion while splanchnic congestion secondary to vascular exclusion was avoided by veno-venous bypass (9). In the same paper, Hannoun advocates that this procedure can be an alternative for liver transplantation in highly selected cases (8) in which poor outcome in cancer therapy is expected due to high rate of recurrence mainly induced by immunosuppression.

In 1994 Souvanet et al described a simplified technique of hepatic ex-situ resection of a centrohepatic tumour with preservation of the hepatic pedicle (ante-situm), thus reducing the duration of the anhepatic phase and avoiding the risk of pedicle elements reconstruction. (Souvanet)

In 1998 Pichlmayr and K.J. Oldhafer are describing the in-situ, ante-situm and ex-situ liver surgical approach for otherwise unresectable hepatic tumours, showing that ante-situm (ex-situ in vivo) surgical resection is the main choice of resection type for liver tumours involving IVC and hepato-caval junction in which the hepatic pedicle can be maintained. This approach avoids the additional morbidity of arterial and biliary reconstruction (1,10).

Vaillant et al are describing in 1998 4 cases of ex-situ in-vivo hepatectomies with hypothermic perfusion of the liver with good postoperative outcome, advocating that hypothermic liver perfusion must be contained in every surgeon's

Figure 4. Left: the sites of vascular clamping before explantation. Middle: Ex Situ – In Vivo explantation of the liver. Right: Final aspect after resection and RHV reimplantation

Figure 5. Intraoperative aspect after reimplantation.

“toolbox”, being even able to extend the surgical indications in certain hepatopathies (11).

In 2000 Oldhafer (12) is reporting a large series of ex-situ liver resections counting 22 cases (3), 2 of them performed for benign liver lesions being alive at 9 and 5 years follow up; a high mortality rate is reported in patients with cholestatic livers.

In the same year Raab et al (9) is reporting the largest series so far, of 24 ante-situm resections out of 54 extracorporeal liver resection, mainly for liver colorectal and breast cancer metastases (15 patients) and symptomatic benign lesions (5 patients), with higher mortality in the ex vivo group than in the ante-situm group.

In 2009 Kim et al are reporting an ante-situm resection in recurrent liver colorectal metastasis in a 58 yo patient with 12 months follow-up without recurrence.

Are Mehrib et. al from Germany are reporting 7 ante-situ hepatic resections combined with hypothermic liver perfusion for malignant liver tumours with 6 patients free of tumor at 10 months follow up.

A report of Y. Yamamoto from 2012 accounts 7 cases of ante-situm resection for malignant liver tumours involving the confluence of hepatic veins and IVC, with a limited but justified survival period due to advanced malignancies of this patients. (13).

Patients with large liver tumours that involve vital vascular structures such as the IVC or the hepatic venous confluence are considered to be poor candidates for resectional surgery. Surgical techniques such as in-situ, ante-situm and ex-situm liver resections have been described to overcome the poor survival associated with non-surgical treatment in these. All the reports describing these procedures are advocating vast HPB surgery and liver transplant experience as sine qua non conditions for surgical teams that aim to perform them. All of them also describe a prolonged anhepatic phase of more than 4 hours that necessitated a hypothermic liver perfusion (9,14,15). A veno-venous extracorporeal bypass (16) or a time-saving transient porto-caval shunt described by Ke-Ming Zhang et al shortened the anhepatic phase duration, thereby reducing the postoperative liver dysfunction (17).

As the safe time limit of liver tolerance to a total vascular exclusion and subsequent ischemia is considered to be less than 60-90 minutes (18), we considered either veno-venous extracorporeal bypass or cannulation of the portal vein for a hypothermic perfusion inappropriate, because the intraoperative estimation of the duration of the resection was 60 minutes prior to total vascular exclusion.

Moreover, in order to obtain a short vascular exclusion and liver ischemia time we performed as much left and right liver lobes mobilization as we could prior to the ante-situm liver mobilisation.

Conclusion

Ante-situm liver resection is a viable procedure for giant liver tumours in highly selected cases. It facilitates resection of large liver tumours that would be otherwise unresectable, extending the indications of surgical treatment (12,19). Ex-situ liver resections are performed by highly skilled hepatic and liver transplant surgeons(20) and usually necessitate a veno-venous bypass or a porto-caval shunting and hypothermic perfusion of the liver unless a shorter than 60-90 minutes anhepatic period can be achieved.

It is important to point out that in the hands

of experienced HPB surgeons, this procedure can solve serious life-threatening intraoperative complications, as illustrated by the present case report. If hypothermic perfusion of the liver can be avoided by swift resection and reimplantation of the hepatic outflow, the postoperative course is significantly shortened and ischaemic liver injury is avoided.

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