CEC (By pass veino veineux)
et
TRANSPLANTATION HEPATIQUE

Laurence CHICHE

CHU BORDEAUX

Un peu d'histoire : Une opération qui a un peu plus de 50 ans

1963, Denver : Thomas Starzl a fait 200 greffes hepatiques chez le chien

Bennie Solis , 3 ans Atrésie des voies bilaires : cirrhose avancée . Donneur : un enfant mourant d'une tumeur cérébrale

Prélèvement sous CEC après arret cardiaque

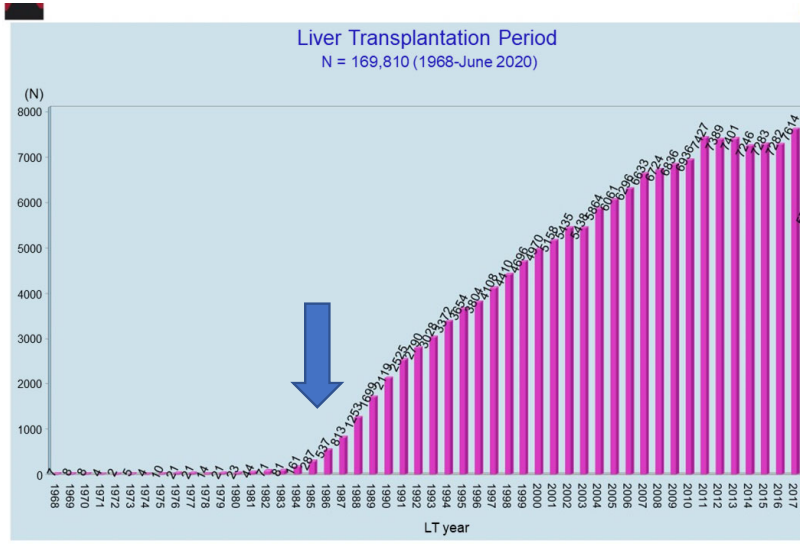
TH cauchemardesque sous CEC : Mort per op

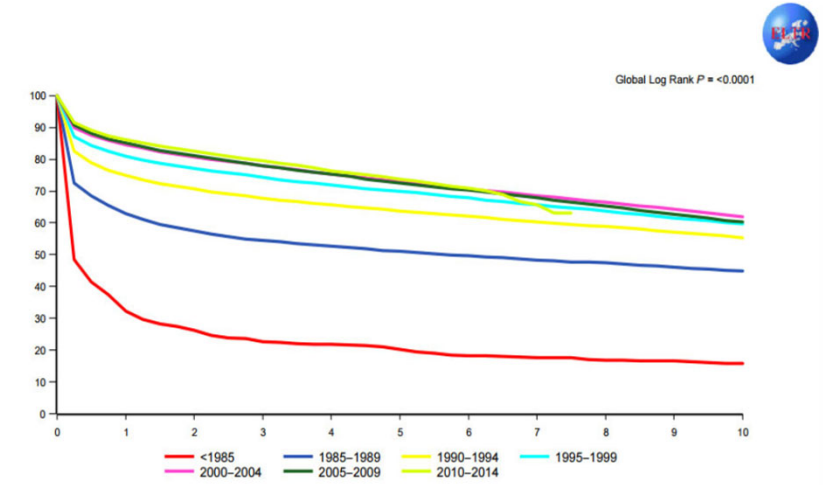
2 autres : décés à 7 et 22 jours Embolie sur thrombose sur canule de CEC

1968 , Pittsburg La greffe marche : sous CEC !

Technique, physiologie, immunologie…

LA TH depuis …





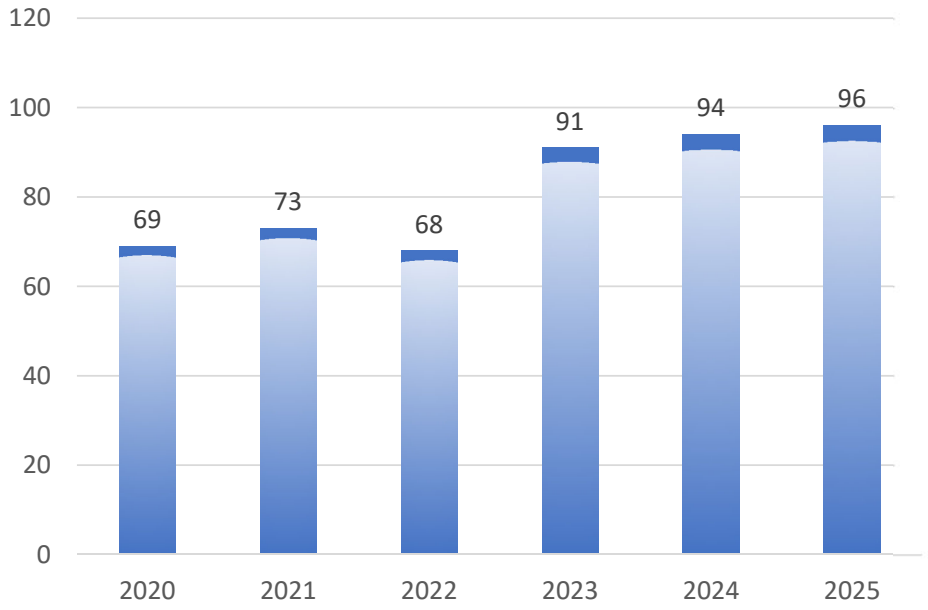
2025 : 1431 TH France
Plus de 7000 en Europe

Mortalité op
7-8 %

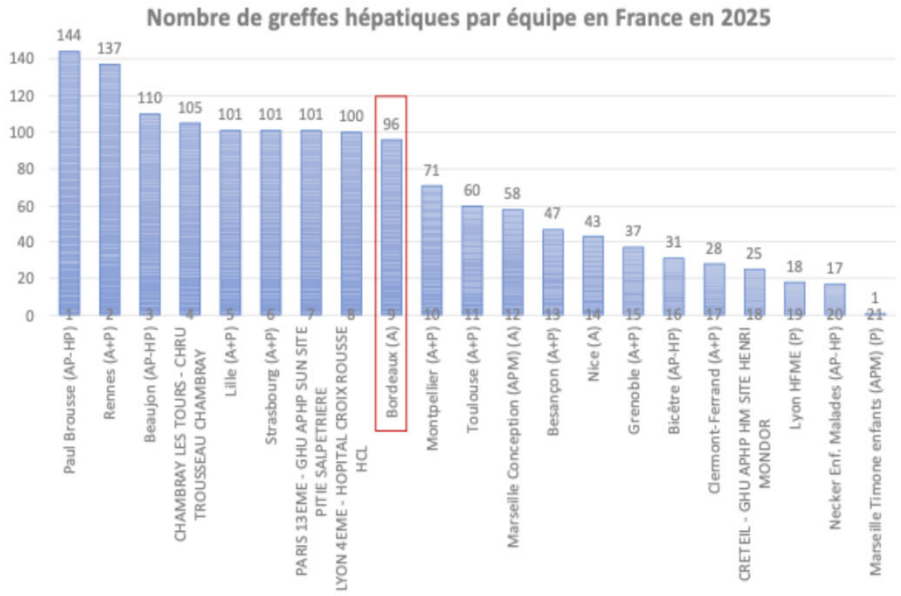
survie : 1 an , 5 ans
1990-95 : 75%, 64%,
2010-15 : 86%, 74%,

Meilleure prise en charge médicale et chir

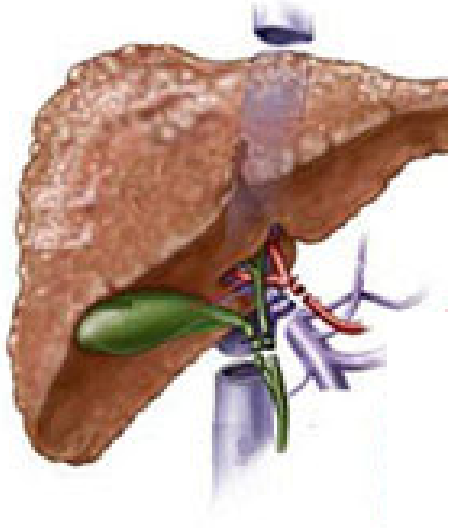
Nombre de TH à Bordeaux sur 6 ans

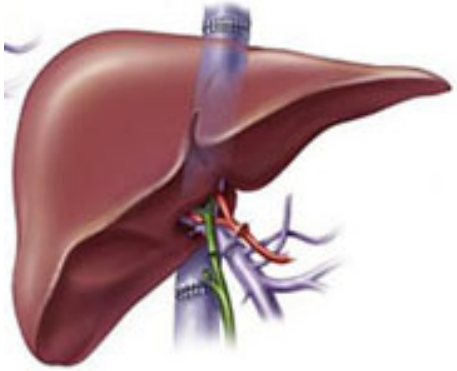


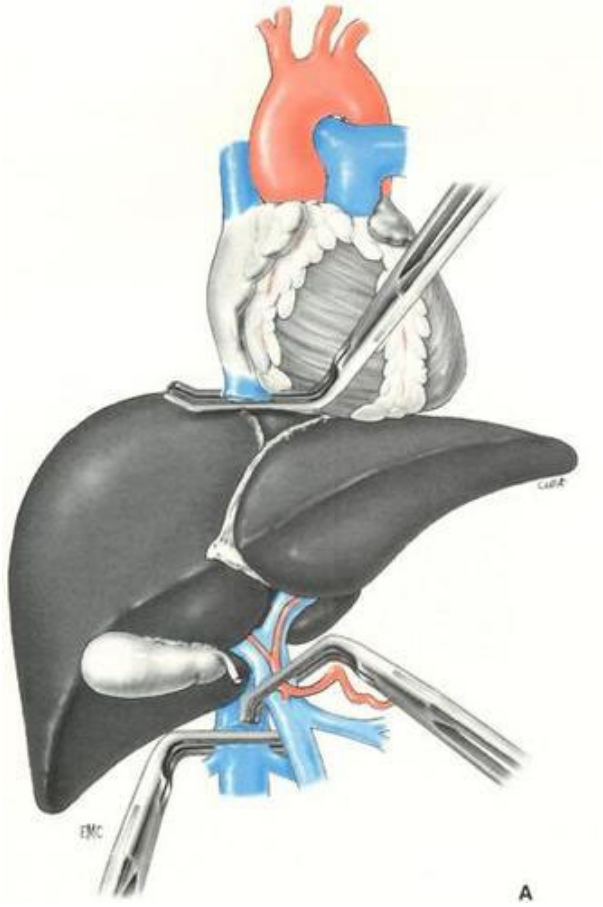
Classement national 2025



Il était une fois au début des années 80







Clampage cave
Clampage portal
… pour un certain temps

Instabilité HD
Hémorragie
Ischémie digestive…

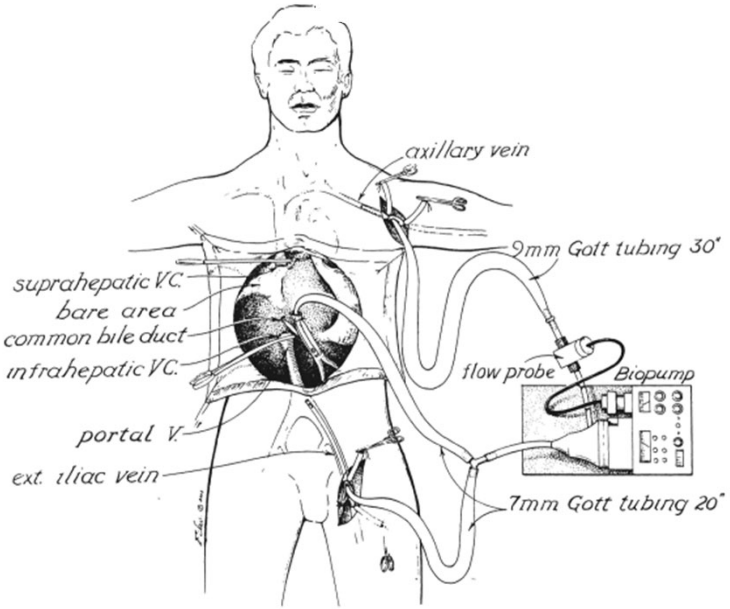
Une pompe extra corporelle : systématique

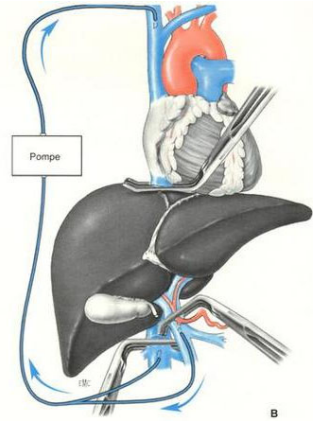
HIGH INTRAOPERATIVE mortality rate BECAUSE of hemodynamic instability during anhepatic phase of OLT…

Ann Surg 1984

Venous Bypass in Clinical Liver Transplantation

BYERS W. SHAW, JR., M.D.,* DOUGLAS J. MARTIN, M.D.,† JOSE M. MARQUEZ, M.D.,† Y. G. KANG, M.D.,†
ALAN C. BUGBEE, JR., PH.D.,† SHUNZABURO IWATSUKI, M.D.,* BARTLEY P. GRIFFITH, M.D.,*
ROBERT L. HARDESTY, M.D.,* HENRY T. BAHNSON, M.D.,* THOMAS E. STARZL, M.D., PH.D.*





Objectif : reinjecter le flux cave et portal dans le système cave sup

- Pompe à galet
- Pas d' heparine
- débit 1,5 L/min à 5 L/min

Pompe extra corporelle en TH

Pendant la transplantation hépatique
Comme en chirurgie hépatique complexe

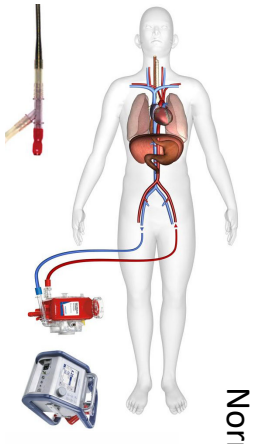
Pompe veino veineuse
Non oxygénée

Pallier au clampage cave
Décharger le système porte

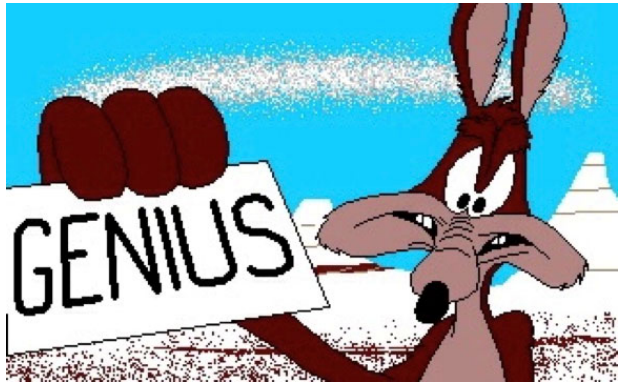
Au cours du PMO
Donneur Maastricht III (donneur à cœur arreté)

Circulation Regionale Normothermique
Héparinée et oxygénée (ECMO)

Perfuser et Protéger les organes
Reduire l'ischémie



En theorie…



Effets de la CEC

Augmente la pression et l'index cardiaque

Permet la perfusion rénale

Décomprime le territoire splanchnique, baisse la pression porte et évite l'oedème viscéral , la stase / ischémie

Benefices attendus

Moins de vasopresseurs

Moins d'IR post op

Moins d'hémorragie

Moins de répercussions HD au déclampage

Baisse de la mortalité , de la morbidité et De la durée de séjour en réa

Années 90 : AVANCEES TECHNIQUES

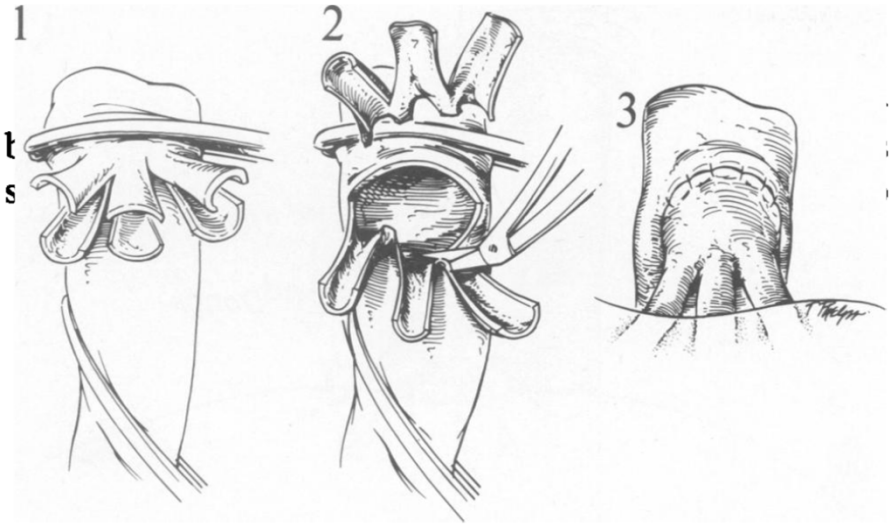
Orthotopic Liver Transplantation with Preservation of the Inferior Vena Cava

Ann Surg 1989

ANDREAS TZAKIS, M.D., SATORU TODO, M.D., and THOMAS E. STARZL, M.D., PH.D.

From the Department of Surgery, University of Pittsburgh Health Center, University of Pittsburgh, Pittsburgh, Pennsylvania

Piggyback orthotopic liver transplantation was performed in 24 patients during a period of 4 months. This represented 19% of the liver transplantations at our institution during that time. The piggyback method of liver insertion compared favorably with the standard operation in terms of patient survival, blood loss, incidence of vascular and biliary complications, and rate of retransplantation. The piggyback operation cannot be used in all cases, but when indicated and feasible its advantages are important enough to warrant its inclusion in the armamentarium of the liver transplant surgeon.



"PIGGYBACK"

0041-1337/94/5807-793$03.00/0
TRANSPLANTATION

Vol. 58, 793–796, No. 7, October 15, 1994
Printed in U.S.A.

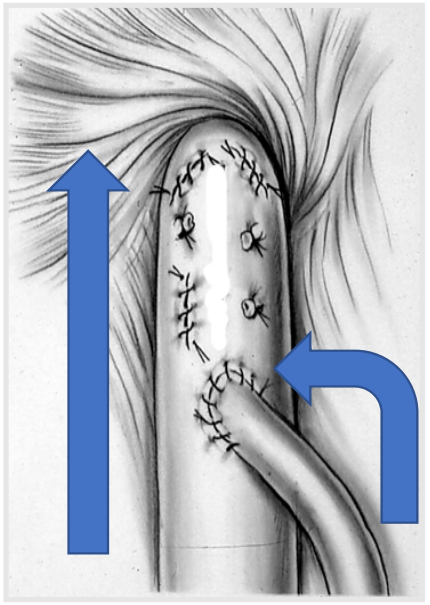
ORTHOTOPIC LIVER TRANSPLANTATION WITH PRESERVATION OF THE CAVAL AND PORTAL FLOWS

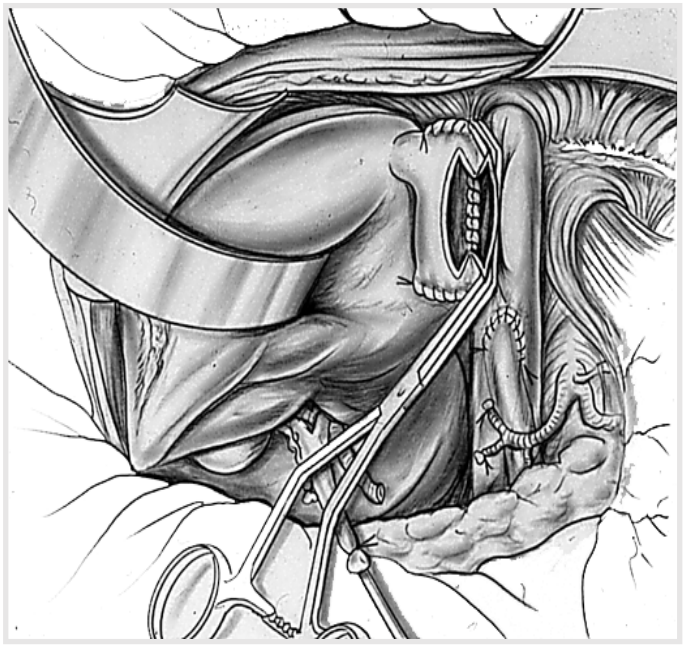
TECHNIQUE AND RESULTS IN 62 CASES

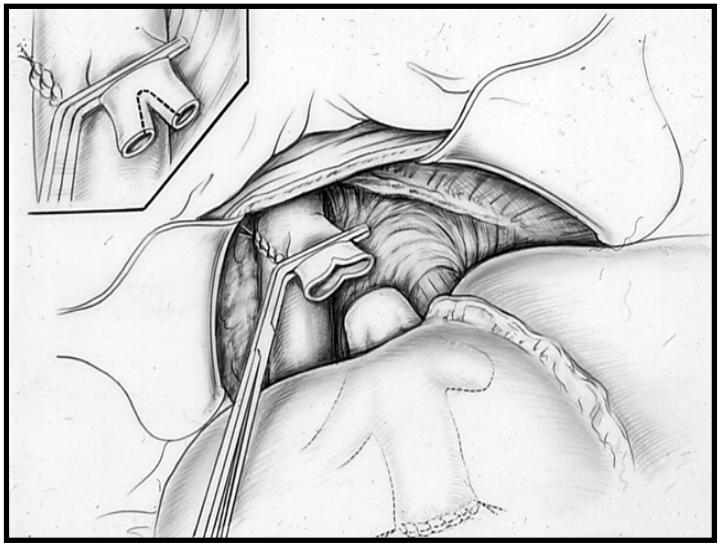
DANIEL CHERQUI,[1–2] JEAN-YVES LAUZET,[3] NELLY ROTMAN,[1] CHRISTOPHE DUVOUX,[4] DANIEL DHUMEAUX,[4] MICHEL JULIEN,[1] AND PIERRE-LOUIS FAGNIEZ[1]

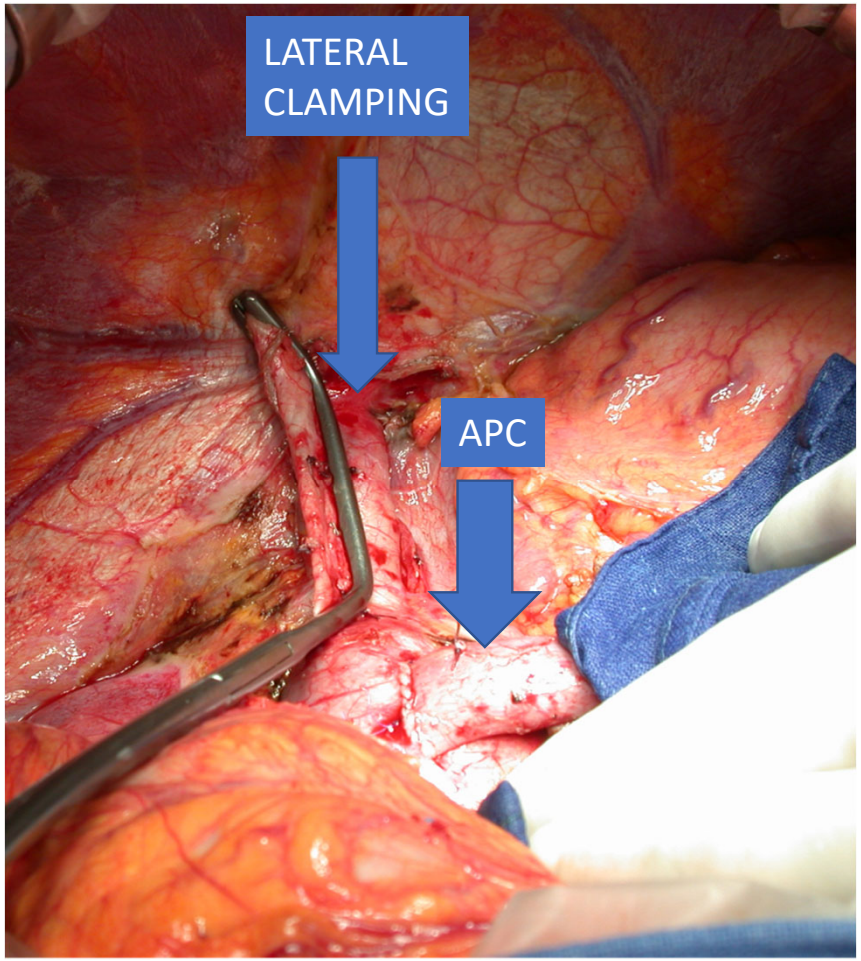
Departments of Surgery, Anesthesiology, and Hepatology, Hôpital Henri Mondor, Université Paris XII, 94010 Créteil, France

Préservation de la VCI
Shunt chirurgical porto cave temporaire

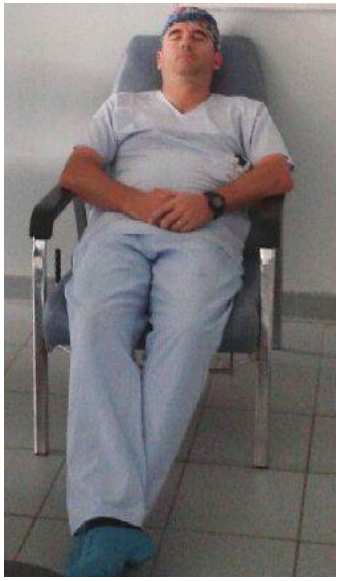







LATERAL
CLAMPING
APC


65
100
43
107 / 52 (65)



Abandonner la CEC ?

OUI

La nouvelle technique , préservant le flux cave ,confère une grande stabilité HD

Et même si on clampe la VC , c'est toléré pendant un certain temps…

Bcp d'études n'ont pas démontré de bénéfices de la CEC

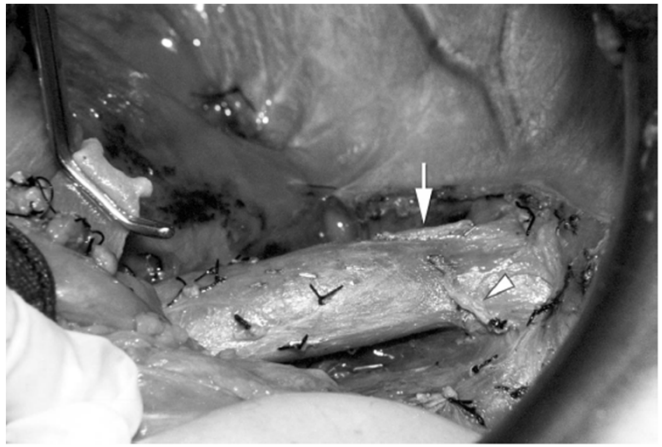
En revanche , elle a sa propre morbidité
Embolie, plaie vasculaire, et consommateur de temps !!! ….

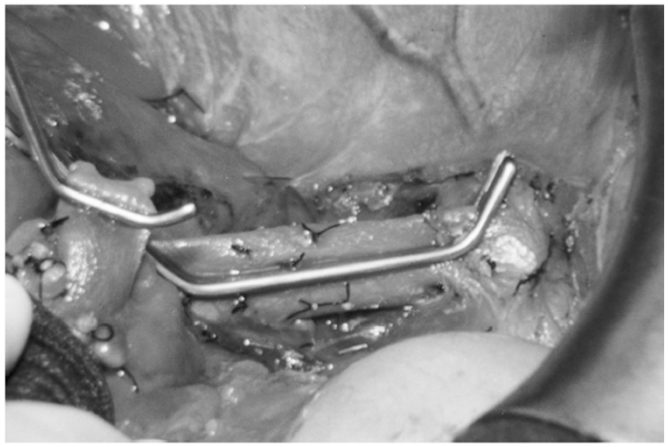
TRANSPLANTATION

May 27, 2003

CAVOCAVAL ADULT LIVER TRANSPLANTATION AND RETRANSPLANTATION WITHOUT VENOVENOUS BYPASS AND WITHOUT PORTOCAVAL SHUNTING: A PROSPECTIVE FEASIBILITY STUDY IN ADULT LIVER TRANSPLANTATION

JAN LERUT,[1,6] OLGA CICCARELLI,[1] FRANCINE ROGGEN,[1] PIERRE-FRANÇOIS LATERRE,[2] ETIENNE DANSE,[3] PIERRE GOFFETTE,[3] SOPHIE AUNAC,[4] MARIANNE CARLIER,[4] MARC DE KOCK,[4] LUC VAN OBBERGH,[4] FRANCIS VEYCKEMANS,[4] CLAUDINE GUERRIERI,[5] RAYMOND READING,[1] AND JEAN-BERNARD OTTE[1]





	Primary LT (%) (n=183)	Re-LT (%) (n=19)	Total (%) (n=202)
IVC preservation	181 (98.9)	17 (89.5)	98
IVC cross clamping absent	170 (93)	16 (84.2)	92
Non use of VVB	182 (99.5)	17 (89.5)	98.5
Portacaval shunting	0	0	0
Cavocaval anastomosis	180[a] (98.4)	17 (89.5)	97.5

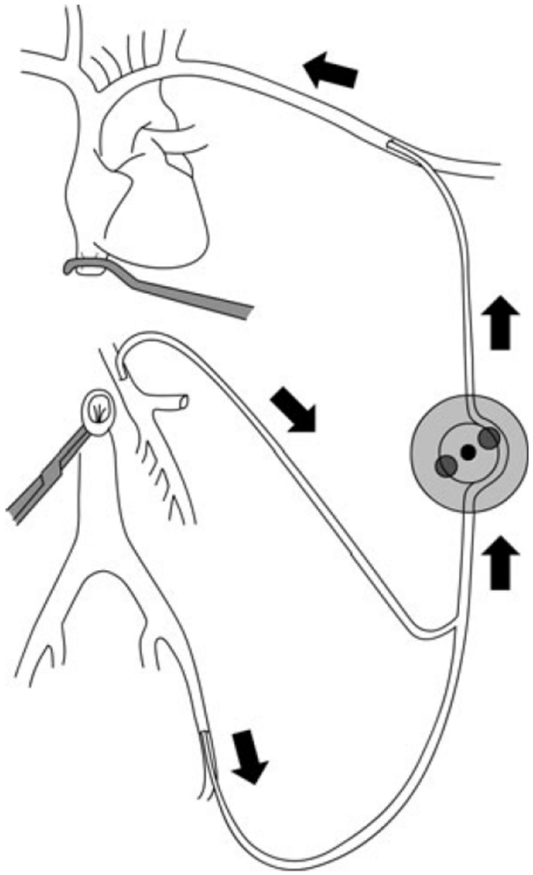
[a] One patient died before implantation of the graft.
IVC, inferior vena cava; VVB, venovenous bypass.

Conclusions. **LT with IVC preservation and without VVB use and portocaval shunting is possible in nearly all primary transplants and in the majority of re-LT.**

Is veno-venous bypass still needed during liver transplantation? A review of the literature

Katrin Hoffmann[a], Markus A. Weigand[b], Norbert Hillebrand[a], Markus W. Büchler[a], Jan Schmidt[a] and Peter Schemmer[a]

Clin Transplant 2009:



renal insufficiency. No single study has shown any disadvantages for LTx without VVB but multiple studies clearly displayed the advantages. There is strong evidence indicating that LTx without VVB should be considered as the standard procedure.

Comparison of surgical methods in liver transplantation: retrohepatic caval resection with venovenous bypass (VVB) versus piggyback (PB) with VVB versus PB without VVB

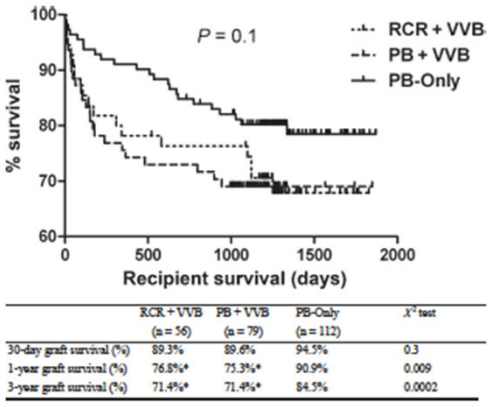
Transplant Int, 2010

Tetsuro Sakai,[1] Takashi Matsusaki,[1] James W. Marsh,[2] Ibtesam A. Hilmi[1] and Raymond M. Planinsic[1]

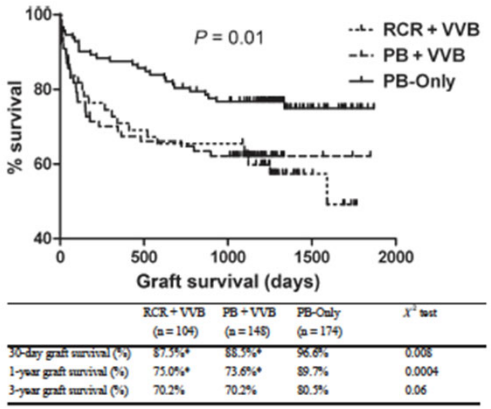
Table 8. Postoperative data.

	RCR + VVB (n = 100)*	PB + VVB (n = 147)*	PB-Only (n = 174)	ANOVA [Kruskal–Wallis]	Chi-square test
ICU stay (days)	5 (2, 128)	6 (2, 105)	4 (2, 70)†	[0.004]	–
Hospital stay (days)	15 (7, 185)	15 (7, 126)	13 (7, 98)	[0.3]	–
Re-intubation	30.0% (30)	26.7% (39)	16.1% (28)¶**	–	0.002
Post/pre creatinine	2.6 ± 1.8	2.5 ± 1.9	1.9 ± 0.9¶**	0.0007	–
Acute renal injury	21.1% (20)†	23.4% (34)‡	17.8% (30)§	–	0.5
Acute renal failure	34.7% (33)†	24.8% (36)‡§	15.4% (26)§¶**	–	0.001
Re-exploration	21.0% (21)	28.1% (41)	17.8% (31)	–	0.08
Hepatic artery thrombosis	2.0% (2)	3.4% (5)	0% (0)	–	0.06

RCR + VVB, retrohepatic caval resection technique with venovenous bypass; PB + VVB, piggyback technique with venovenous bypass; PB-Only, piggyback technique without venovenous bypass.



	RCR + VVB (n = 56)	PB + VVB (n = 79)	PB-Only (n = 112)	X^2 test
30-day graft survival (%)	89.3%	89.6%	94.5%	0.3
1-year graft survival (%)	76.8%*	75.3%*	90.9%	0.009
3-year graft survival (%)	71.4%*	71.4%*	84.5%	0.0002



	RCR + VVB (n = 104)	PB + VVB (n = 148)	PB-Only (n = 174)	X^2 test
30-day graft survival (%)	87.5%*	88.5%*	96.6%	0.008
1-year graft survival (%)	75.0%*	73.6%*	89.7%	0.0004
3-year graft survival (%)	70.2%	70.2%	80.5%	0.06

Caval resection +VVBP
Piggy back +VVBP
Piggy back alone +++

In summary, this retrospective, observational study suggests that the combination of retrohepatic caval preservation (PB) with elimination of VVB has clinical benefits over the classic RCR with VVB or the PB technique with VVB in adult primary isolated deceased donor LT. We found that the benefit of the PB technique was decreased when it was combined with VVB.

Veno-venous bypass versus none for liver transplantation (Review)

Cochrane Library
Cochrane Database of Systematic Reviews
Cochrane Database of Systematic Reviews 2011,

Gurusamy KS, Koti R, Pamecha V, Davidson BR

Selection criteria

We included randomised clinical trials comparing veno-venous bypass during liver transplantation (irrespective of language or publication status).

Main results

We identified three trials with high risk of bias which compared veno-venous bypass (n = 65) versus no veno-venous bypass (n = 66). None of the trials reported patient or graft survival. There were no significant differences regarding renal failure or blood transfusion requirements between the two groups. None of the trials reported on the morbidity related to veno-venous bypass or the requirement of veno-venous bypass in the control group.

Authors' conclusions

There is no evidence to support or refute the use of veno-venous bypass in liver transplantation. There is no evidence to prefer any particular technique of veno-venous bypass in liver transplantation.

Use of an intraoperative VVBP during libver transplantation : an observational, single center, cohort study

Gianmarco GUARINO et al

Minerva Anestesiol 2022 Jul 88 (7-8) 554

38 patients 20 with and 18 without

Our data suggest that the use of VVBP fails to release the renal venous backflow from IVC with the same rate of post op kidney failure in both group …

Complications

The use of VVB is not without risks, and serious fatal adverse effects have been reported. A North American survey of 50 major liver transplant centers reported a complication rate of 10-30%, with 1 death from pulmonary embolism.[3] Complications can be divided into those associated with use of extracorporeal circuit and those related to vascular access.

Gas Embolism, clotting , aneurisms, hematomas, seromas …

Abandonner la CEC ?

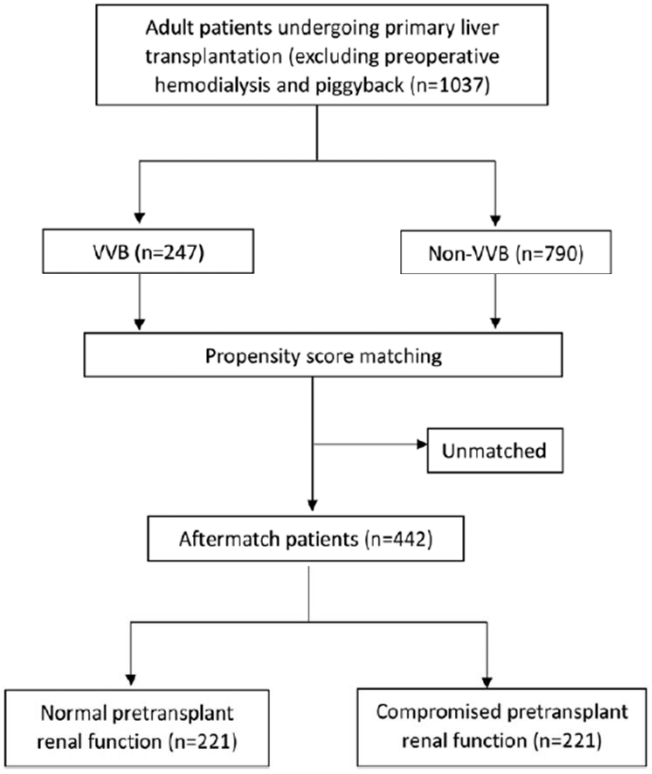
PAS SI VITE !

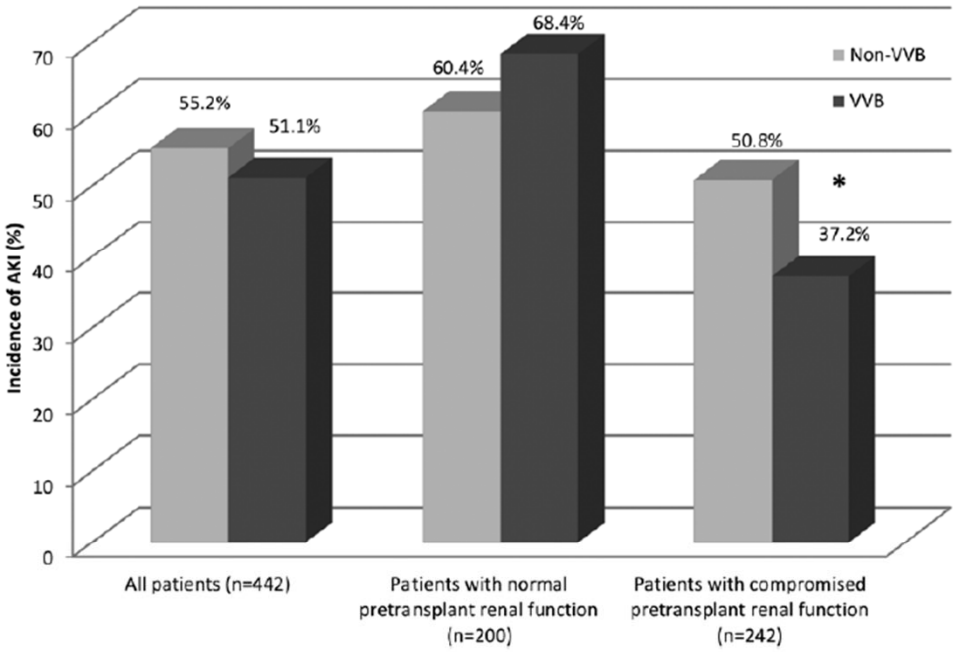
Venovenous Bypass Is Associated With a Lower Incidence of Acute Kidney Injury After Liver Transplantation in Patients With Compromised Pretransplant Renal Function

K Sun et al

ANESTHESIA & ANALGESIA

November 2017





CONCLUSIONS: In this large retrospective study, we demonstrated that utilization of intraoperative VVB was associated with a significantly lower incidence of posttransplant AKI in patients with compromised pretransplant renal function. Further studies to assess the role of intraoperative VVB in posttransplant AKI are warranted. (Anesth Analg 2017;125:1463–70)

Randomized Trial Comparing Pulmonary Alterations After Conventional with Venovenous Bypass Versus Piggyback Liver Transplantation

Liver Transplantation, Vol 10, No 3 (March), 2004:

Maria Rita Montenegro Isern,[3] Paulo Celso Bosco Massarollo,[1,2,3] Eliane Maria de Carvalho,[3] Carlos Eduardo Sandoli Baía,[1,2,3] Jorge Kavakama,[4] Poliana de Andrade Lima,[3] and Sérgio Mies[1,2,3]

The aim of this study is to compare pulmonary alterations after conventional with VVB versus piggyback LT. Sixty-seven patients were randomized for conventional VVB (n = 34) or piggyback (n = 33) LT. Pulmonary static

Upon the radiological evaluation, piggyback group presented a higher frequency of pulmonary infiltrates (80.6% vs. 50.0%; $P = .025$). In conclusion, piggyback LT recipients have a higher rate of pulmonary infiltrates when compared to those operated upon using the conventional VVB method. (*Liver Transpl 2004;10:425–433.*)

Research Article

Bypass during Liver Transplantation: Anachronism or Revival? Liver Transplantation Using a Combined Venovenous/Portal Venous Bypass—Experiences with 163 Liver Transplants in a Newly Established Liver Transplantation Program

Always…

Anne Mossdorf,[1] Florian Ulmer,[1] Karsten Junge,[1] Christoph Heidenhain,[1] Marc Hein,[2] Ilknur Temizel,[3] Ulf Peter Neumann,[1] Wenzel Schöning,[1] and Maximilian Schmeding[1]

Gastroenterology Research and Practice 2015

Introduction. The venovenous/portal venous (VVP) bypass technique has generally become obsolete in liver transplantation (LT) today. We evaluated our experience with 163 consecutive LTs that used a VVP bypass. *Patients and Methods*. The liver transplant program was started in our center in 2010. LTs were performed using an extracorporal bypass device. *Results*. Mean operative time was 269 minutes and warm ischemic time 43 minutes. The median number of transfusion of packed cells and plasma was 7 and 14. There was no intraoperative death, and the 30-day mortality was 3%. Severe bypass-induced complications did not occur. *Discussion*. The introduction of a new LT program requires maximum safety measures for all of the parties involved. Both surgical and anaesthesiological management (reperfusion) can be controlled very reliably using a VVP bypass device. Particularly when using marginal grafts, this approach helps to minimise both surgical and anaesthesiological complications in terms of less volume overload, less use of vasopressive drugs, less myocardial injury, and better peripheral blood circulation. *Conclusion*. Based on our experiences while establishing a new liver transplantation program, we advocate the reappraisal of the extracorporeal VVP bypass.

Abandonner la CEC ?

NON

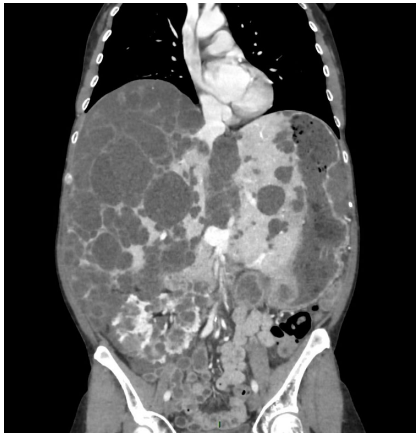
Si IR pre op , ameliore la fonction rénale, moins de complications pulmonaires

Parfois le remplacement de la VCI est indispensable

Hypertensionportale majeure et pas de APC possible
Thrombose portale
Accés difficile

Clampage lateral ou portal mal toléré

Certains sont des inconditionnels – confort +++



So ?

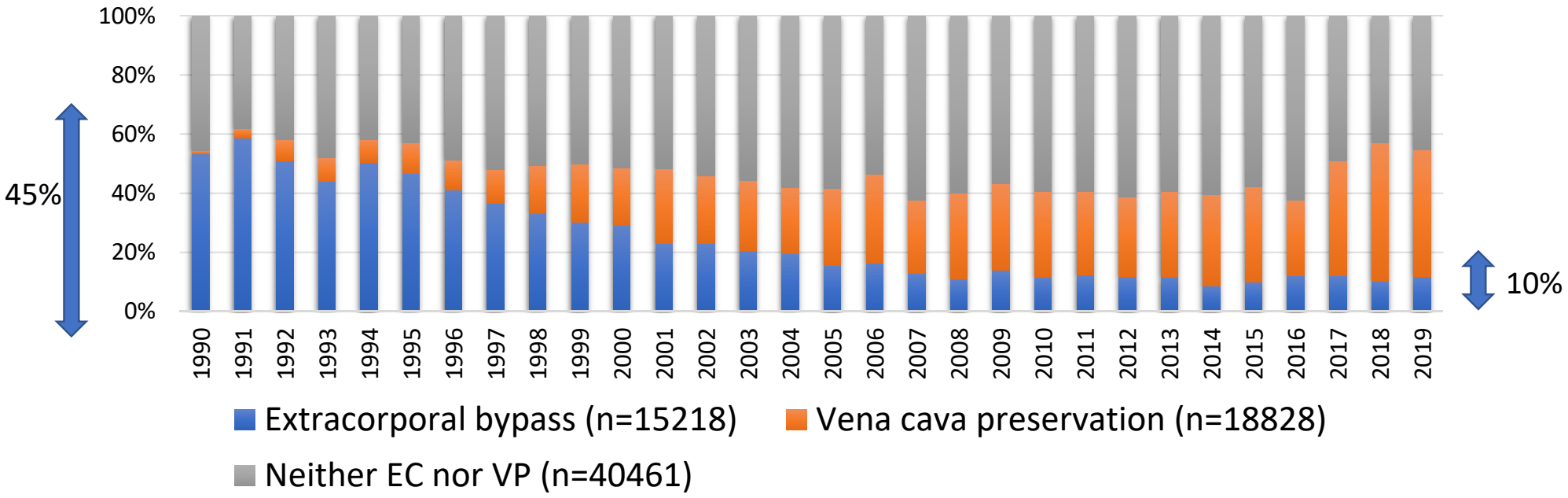
CEC en transplantation

~~Jamais~~

~~Toujours~~

Indications sélectives

Evolution of Bypass use during Liver Transplantation in Europe (1990-2019)



A BORDEAUX 2025 / 3 CEC / 96 GREFFES

www.eltr.org

Venovenous Bypass in Adult Orthotopic Liver Transplantation: Routine or Selective Use?

Table 3. Reported Indications for the Selective Use of Venovenous Bypass

Classification	Indication	Reference
Cardiac and hemodynamic	Preexisting cardiac disease that can be adversely affected by tachycardia, a decrease in cardiac output, or a rapid increase in systemic vascular resistance	18, 48–51
	Patient treated by β-adrenergic antagonists	52
	Hemodynamic instability with IVC and portal vein test cross-clamping for 3–5 minutes, despite optimal volume loading and hemodynamic support	14, 19, 23, 37, 38, 45, 49, 53
Pulmonary	Pulmonary hypertension	9
	Pulmonary edema and acute volume overload	54
Renal	Severe renal insufficiency	49
Neurologic	Acute fulminant liver failure and raised intracranial pressure	38, 50, 53
Liver/splanchnic	Limited retroperitoneal venous collateralization	54
	Massive hepatomegaly	9, 33
	Severe portal hypertension	9, 33, 49
Technical	Massive bleeding during hepatectomy	38
	Large-for-size donor liver	33
	Splanchnic stasis with bowel engorgement and ischemia	17, 29
	Previous major upper abdominal surgery	49
Miscellaneous	Age >55 y	9

Chari et al, JACS 1998

Indications de CEC

En rapport avec la maladie hépatique

HTP sévère avec adhérences

risque majeur de saignement

remplacement de VCI

En rapport avec le patient:

Alteration de la fct cardiaque

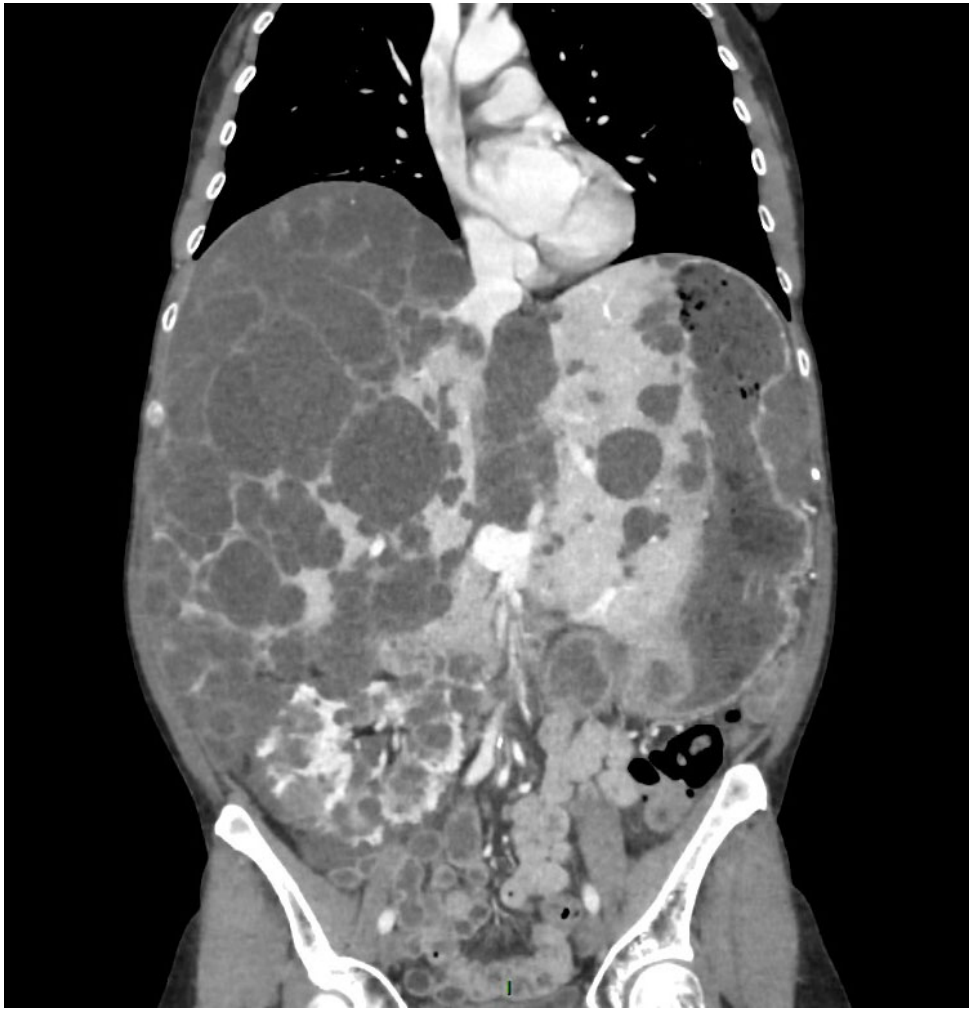
I Rénale pré op sévère?

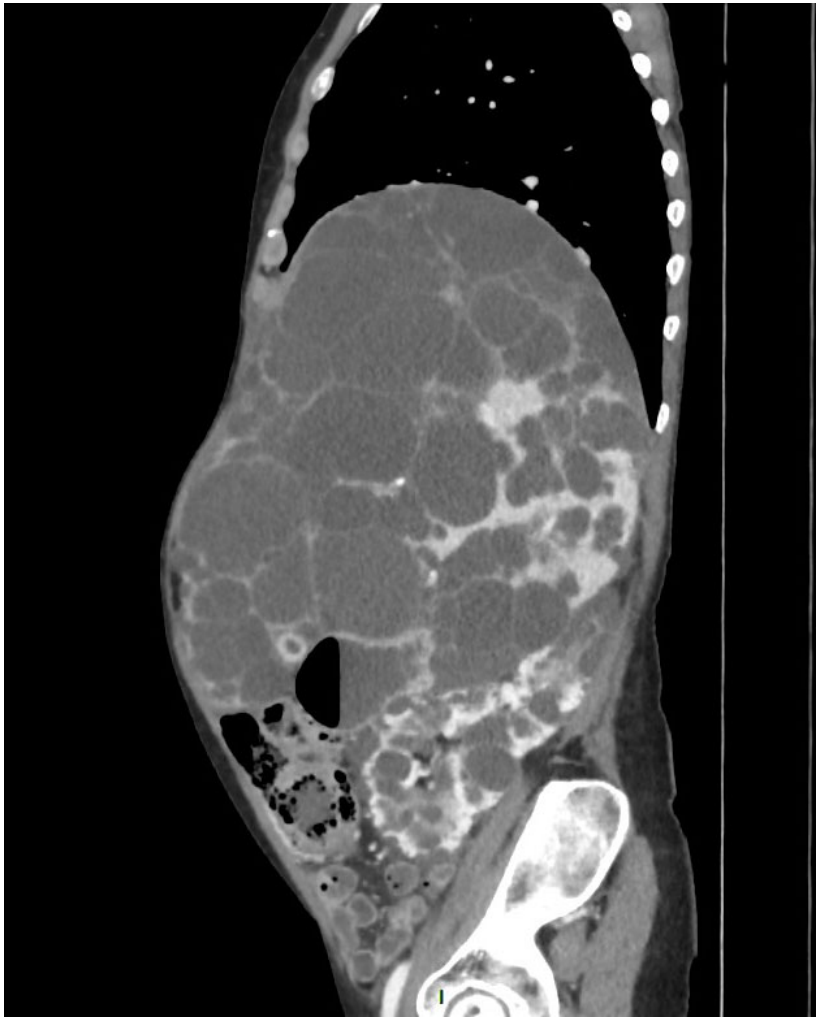
Hépatite fulminante ?

selon les circonstances

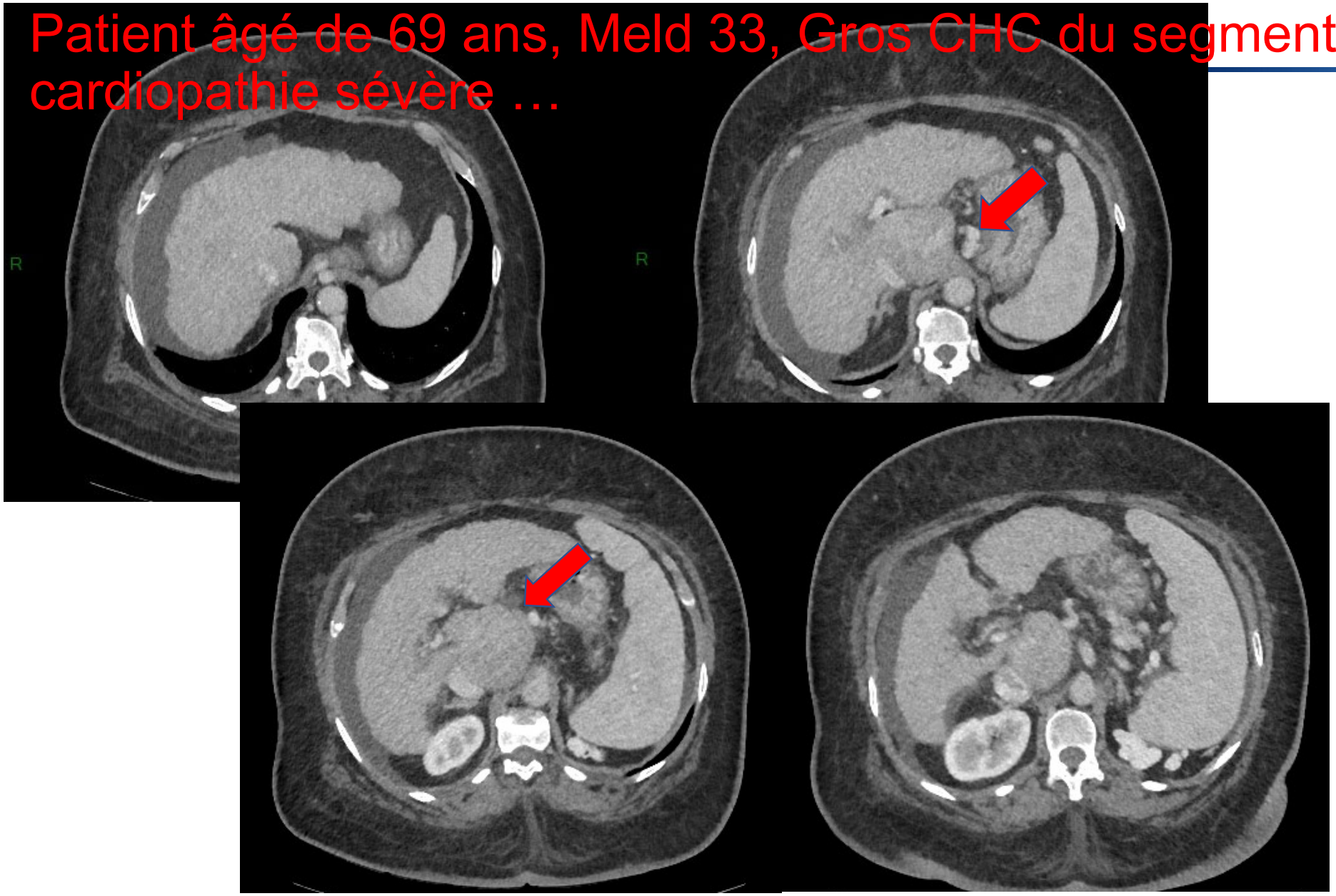
Instabilité hémodynamique pendant l'hépatectomie (TIPS)

On conserve la Cave… ?



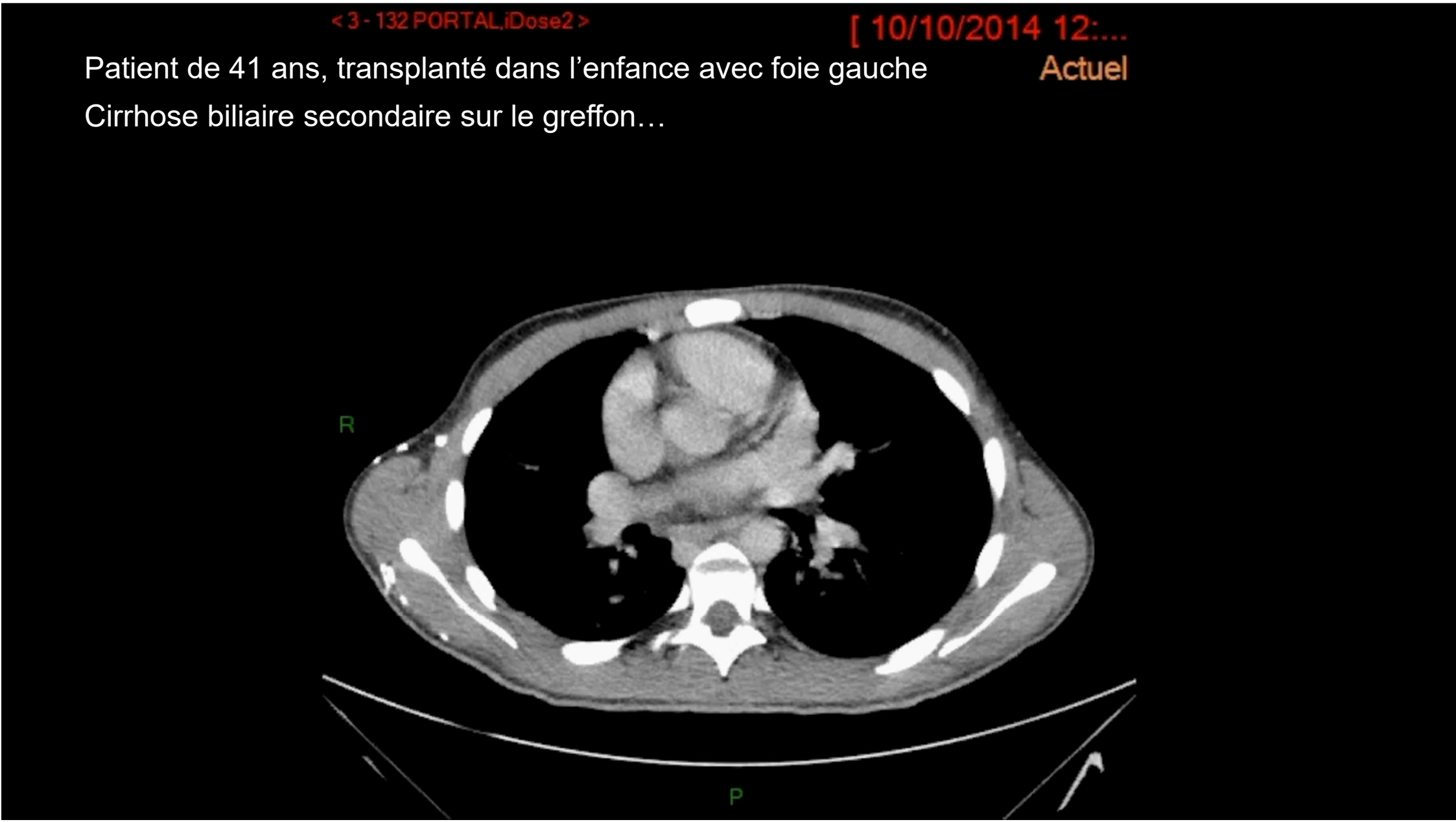


Patient âgé de 69 ans, Meld 33, Gros CHC du segment 1 cardiopathie sévère …



Patient de 41 ans, transplanté dans l’enfance avec foie gauche

Cirrhose biliaire secondaire sur le greffon…



De la theorie à la pratique:

Evidence based medecine → **Experience based medecine**

CE QU IL NE FAUT PAS FAIRE: Se rendre compte pendant la TH qu'il faut la CEC

CE QU IL FAUT FAIRE :

ANTICIPATION
COMMUNICATION CHIR - MAR

car

1) après saignement massif et instabilité +++ c'est souvent trop tard
2) une CEC , ça se prépare !!

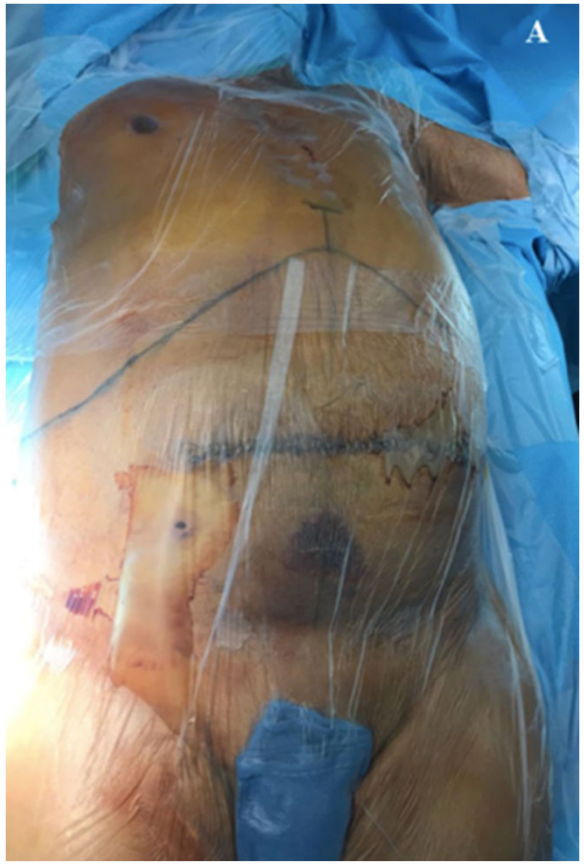
Exemple : Retransplant : anticiper?

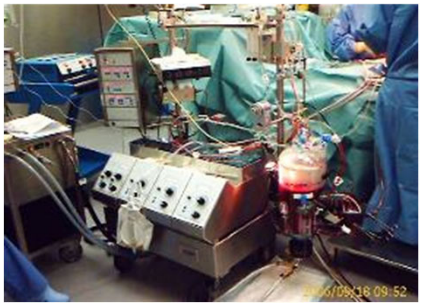
Laroche et al, Transplant Int 2021

Variables	No CEC (N=46)	CEC (N=20)	P
MELD > 14	19 (41%)	15 (75%)	0.024
Sign of PHT	11 (24%)	11 (55%)	0.029
Delay from 1rst LT > 60 m	23 (50%)	18 (90%)	0.005

0 factor : 0/10 (0%)
1 factor : 4/23 (17%)
2 factors : 8/25 (32%)
3 factors : 8/8 (100%)

CEC : technique





Check list

Acces vasc :	LIBRES (attention aux KT)
Canules (18Fr,20Fr)	preparées
chirurgiens	experimentés
IBODE …	informées and entrainées
Perfusionistes	Dispo , avec un corps de pompes !

Connaitre les gags et réagir vite
Monitorer le flux(3l/mn) si pb : voir canules
Limiter le temps(temperature/ bleeding)

Le moins on en fait, le plus dur ce sera,

CEC : technique

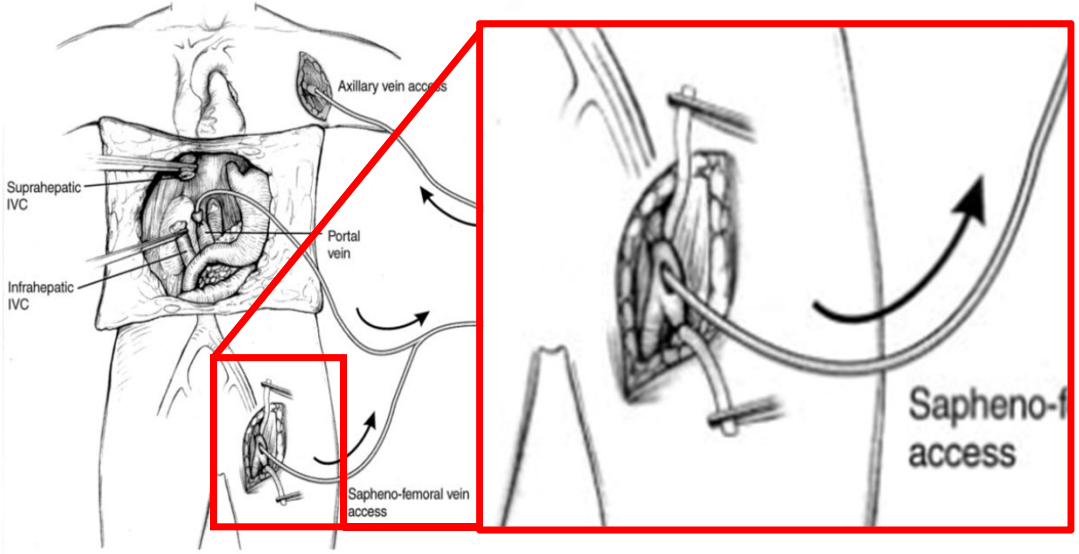
Voies d'abord : initialement chirurgicale

Traditionnellement abord du scarpa , veine saphène et veine fémorale ….

Abord veine axillaire ou veine jugulaire pour a canule sus diaphragmatique

AVANTAGE : facile et sûr

INCONVENIENT : deux abords , deux cicatrices , deux morbidités possibles

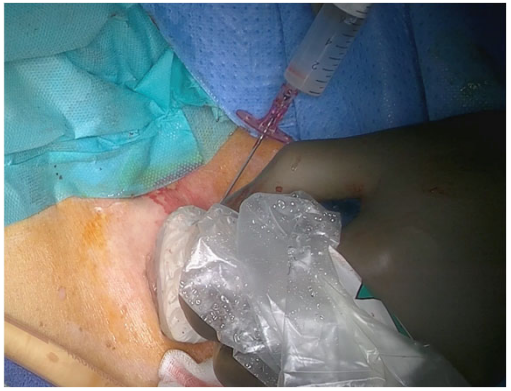


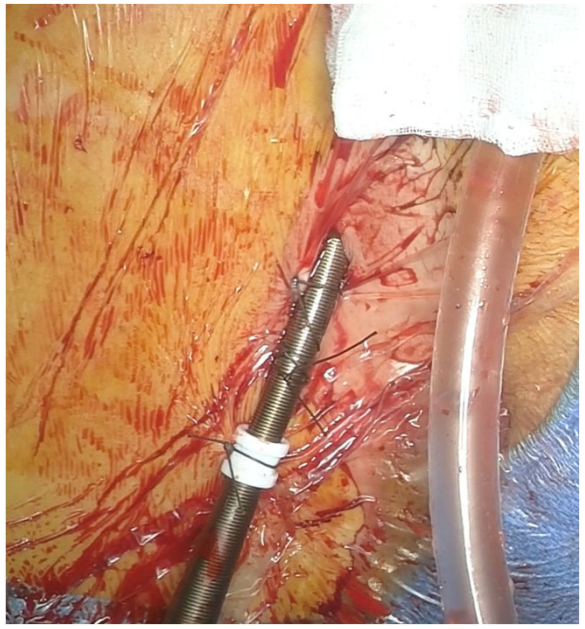
Aujourd'hui : abord plutôt mixte : percutané +++

Abord du système cave: percutané / porte : chirurgical

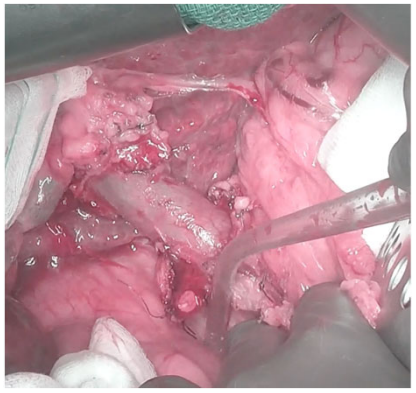
Canule de sortie :

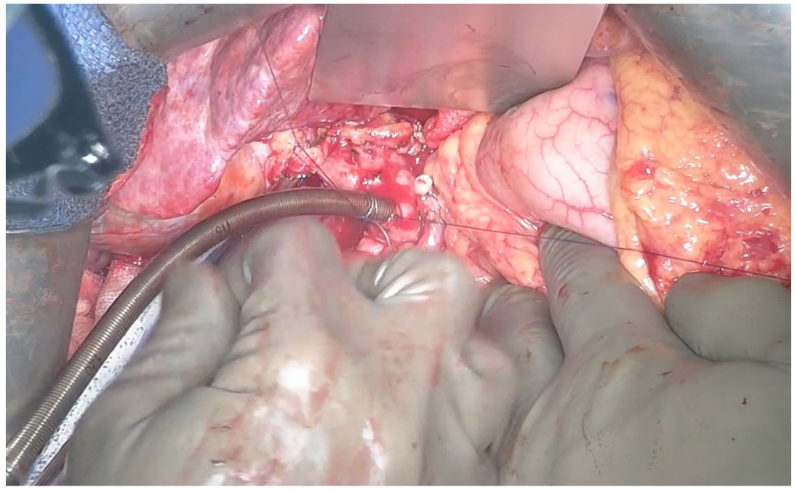
veine femorale





veine porte ou veine mésenterique

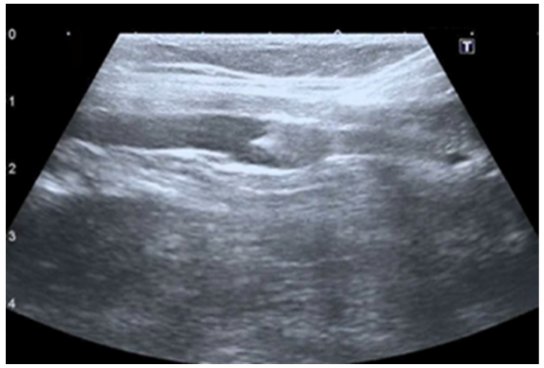


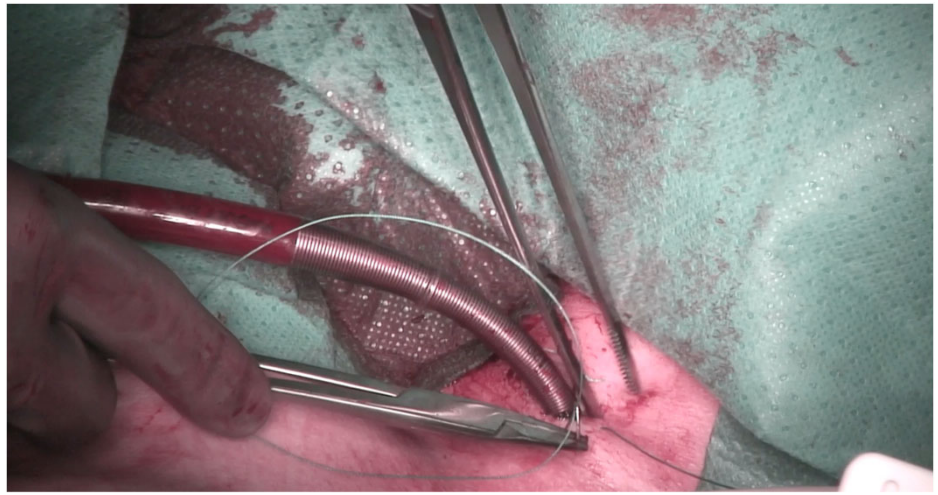


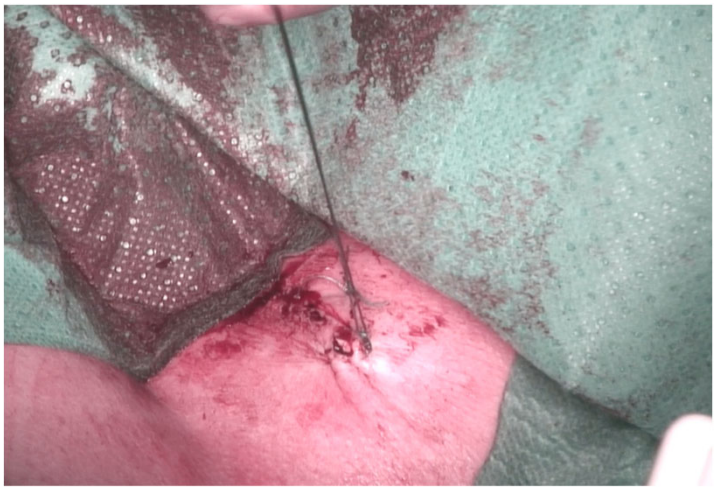
Canule d’entrée :

veine jugulaire droite

abord sous contrôle echo







echographie cardiaque et scope

Mise en place des canules en percutané : moins invasif , plus rapide…?

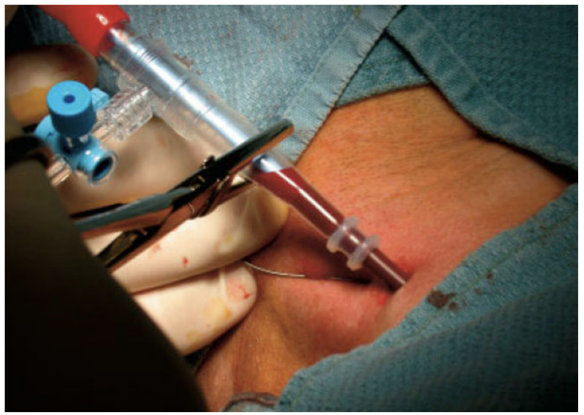
Clin Transplant 2010: 24: 585–591 DOI: 10.1111/j.1399-0012.2009.01145.x

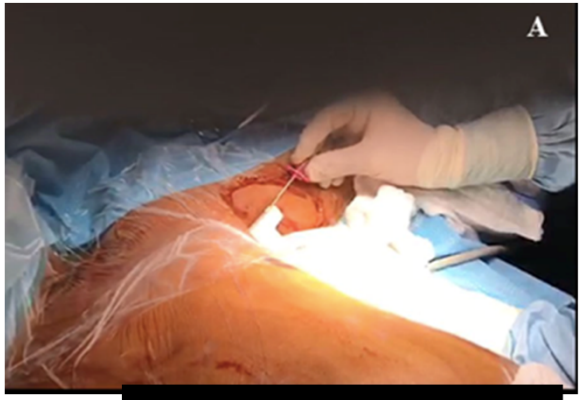
Clinical Transplantation

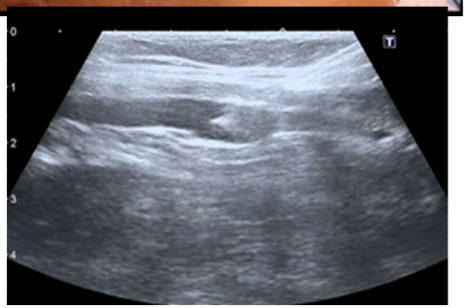
Insertion and management of percutaneous veno-venous bypass cannula for liver transplantation: a reference for transplant anesthesiologists

Sakai T, Gligor S, Diulus J, McAffee R, Marsh JW, Planinsic RM. Insertion and management of percutaneous veno-venous bypass cannula for liver transplantation: a reference for transplant anesthesiologists. Clin Transplant 2010: 24: 585–591. © 2009 John Wiley & Sons A/S.

Tetsuro Sakai[a], Silviu Gligor[b]*, John Diulus[c], Richard McAffee[d], J. Wallis Marsh[e] and Raymond M. Planinsic[f]







We identified one trial with high risk of bias which compared percutaneous (n = 20) versus open technique (n =19) of veno-venous bypass. The patient or graft survival was not reported. There was no difference in veno-venous bypass related morbidity between the two groups. The operating time was significantly shorter in the percutaneous technique group (MD -59 minutes; 95% CI -102 to -16).

CEC : technique

Principe

Bonne installation des circuits (visibles)

clamp à portée de main (plaies vasculaire , risque d'embolie /désamorçage)

bonne communication (bon débit)

temps de CEC le plus court possible (hypothermie) : rendre la CEC avant l'anastomose artérielle si possible

sinon : problème cave +++

Conclusion

Il y a peu (pas) de preuve formelle (EBM) de l'intérêt de la CEC et les études rétrospectives sont contestables

Dans la grande majorité des cas , on conserve la veine cave et la CEC est inutile

MAIS il persiste des indications , soit en relation avec le patient soit avec la greffe

Retransplantation avec très sévère HTTP +++

Thrombose portale et cavernome chez patient déjà laparotomisé

Remplacement cave nécessaire chez un patient cardiaque ou fragile

IRC et co morbidité cardio pulm

Discussion LORS de l'inscription +++ discussion entre chirurgiens et MAR mieux vaut le prévoir mais parfois on peut le décider en per op (STOP AND THINK)ET PAS TROP TARD . A bordeaux : entre 2 et 4 CEC pour TH par an (94 greffes)