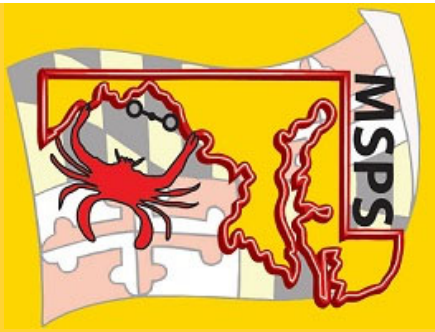
MAVES
Mid-Atlantic VAD and ECMO Symposium



Welcome to the 12th Annual MAVES

3 May 2020

MAVES
Mid-Atlantic VAD and ECMO Symposium

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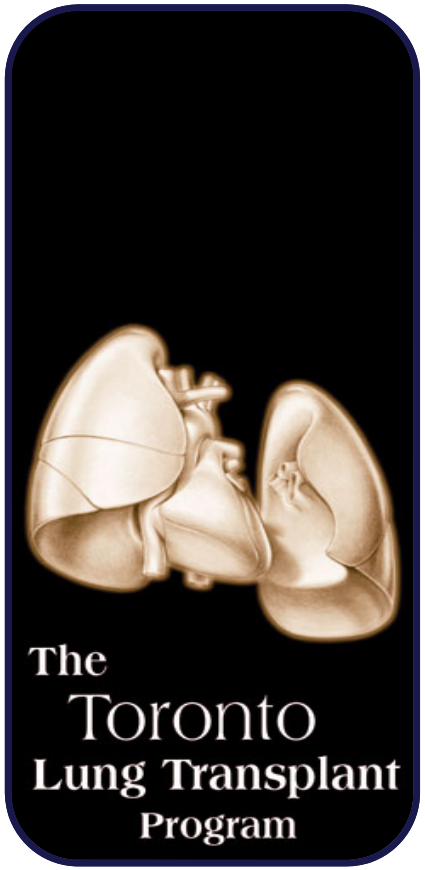
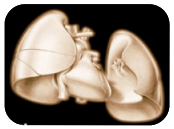


Update on Exvivo Perfusion

Cyril Serrick MSc, CPC, CCP
Manager – Perfusion Services and Exvivo Technologies
University Health Network, Toronto General Hospital
Toronto, Ontario, Canada

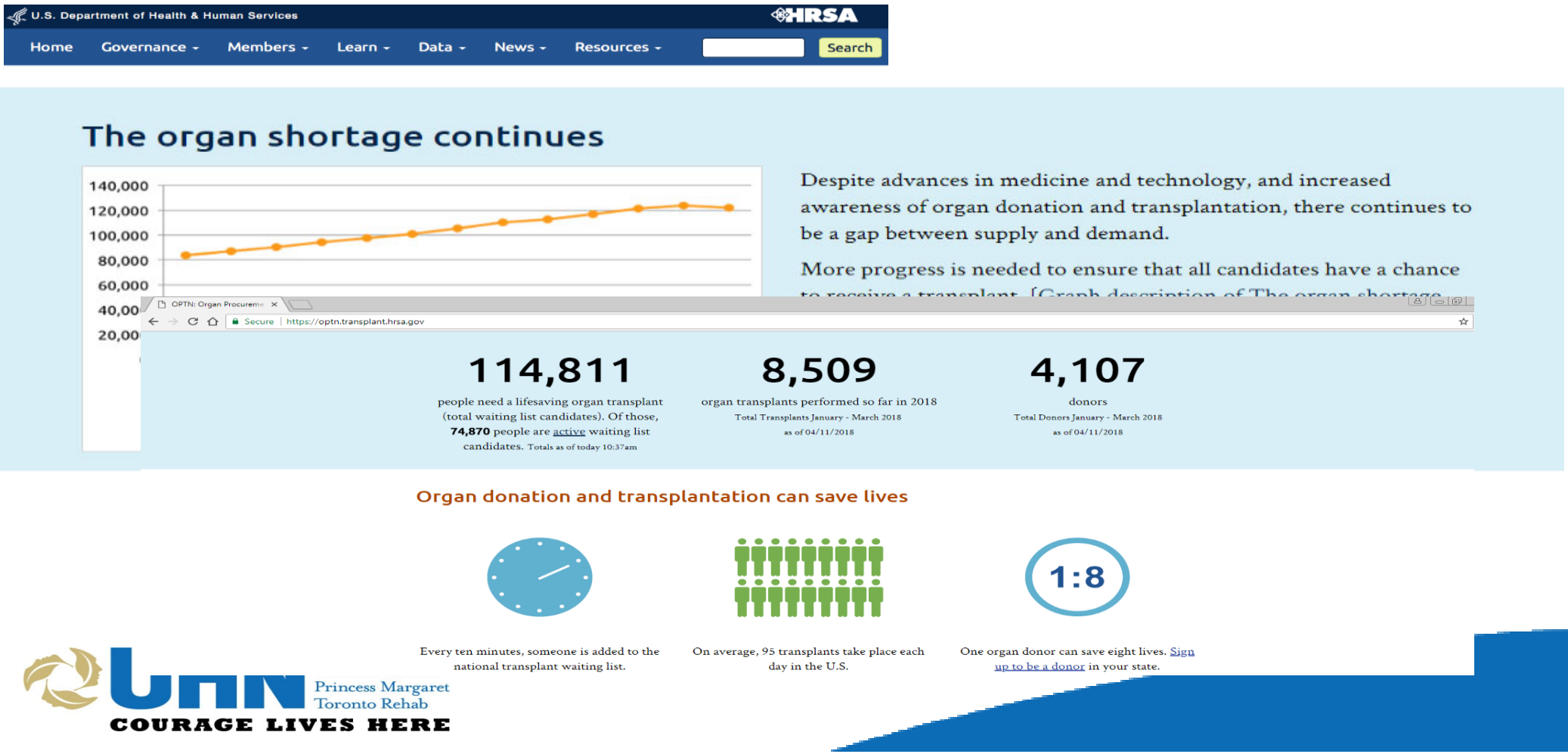
University Health Network



Major Obstacle for Transplantations

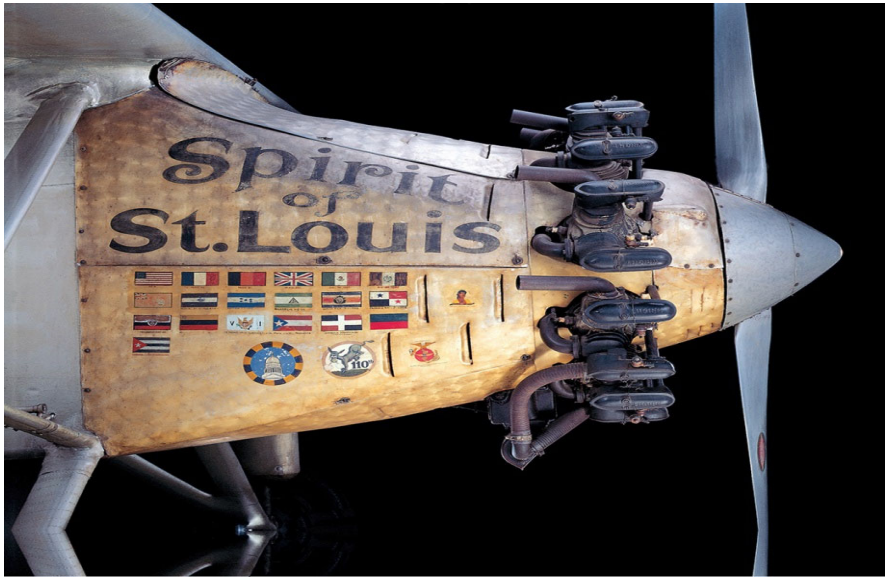
- Absence of sufficient organs to meet the growing demand
- Up to 30% patients die on wait lists
- Larger number of patients are not even listed

The Organ Shortage

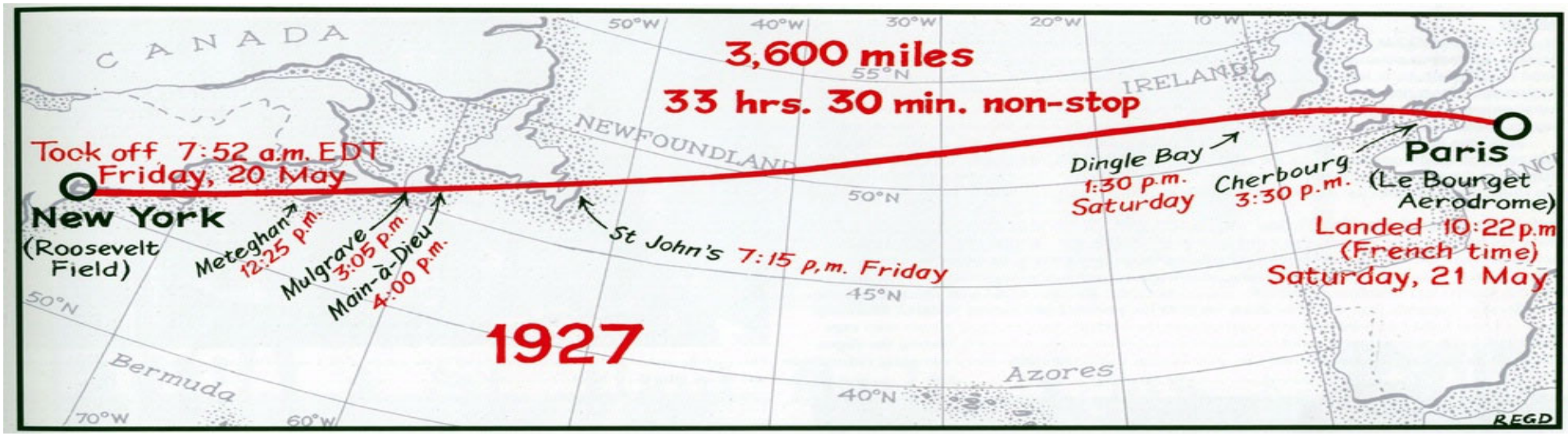


UHN Princess Margaret Toronto Rehab
COURAGE LIVES HERE

Charles Lindenburg



UHN Toronto General Hospital



- May 20, 1927
- First nonstop flight from NY to Paris
- 200 miles across the Atlantic
- Total distance of 3600 miles
- Time 33.5 hours


BROOKLYN DAILY EAGLE

LINDBERGH AT PARIS IN 33½ HOURS; SLEPT ON WAY; RAN THROUGH STORM

'HERE WE ARE,' HIS FIRST GREETING TO FRENZIED THRONG

BELLANCA FLIGHT

UHN Toronto General Hospital

SPECIAL ARTICLES

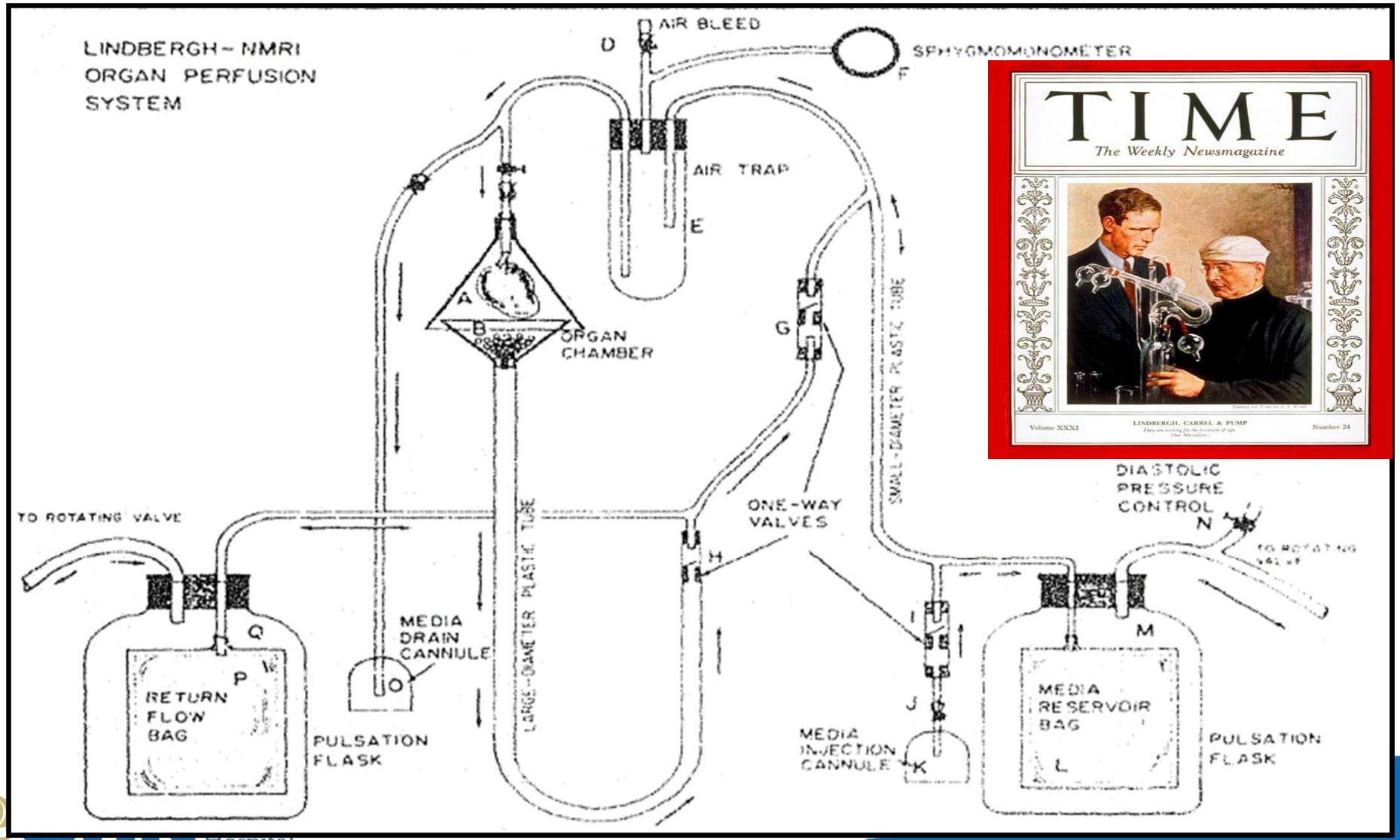
THE CULTURE OF WHOLE ORGANS

THE method to be described consists of the transplantation of an organ or of any part of the body into a sterile chamber, and of its artificial feeding with a nutrient fluid through the arteries. It is not in any way a substitute for the method of tissue culture. Its techniques, as well as its purposes, are quite different. As is well known, tissues and blood cells grow like bacteria in flasks containing appropriate media. The techniques for the cultivation of tissues are somewhat analogous to bacteriological techniques, although far more delicate. But it is through the employment of complex mechanical and surgical procedures that organs are enabled to live isolated from the body. Tissue culture deals with cells as units of bodily structures; the new method, with cellular societies as organic wholes. Its ultimate purposes are the manufacture *in vitro* of the secretions of endocrine glands, the isolation of the substances essential to the growth, differentiation and functional activity of those glands, the discovery of the laws of the association of organs, the production *in vitro* and the treatment of organic and arterial diseases, etc.

The idea of maintaining alive a portion of the body in order to study its functions is not new. In 1812, the physiologist Le Gallois[1] wrote that, "if one could sub-

Lindbergh, *Science*, 1935

UHN Toronto General Hospital

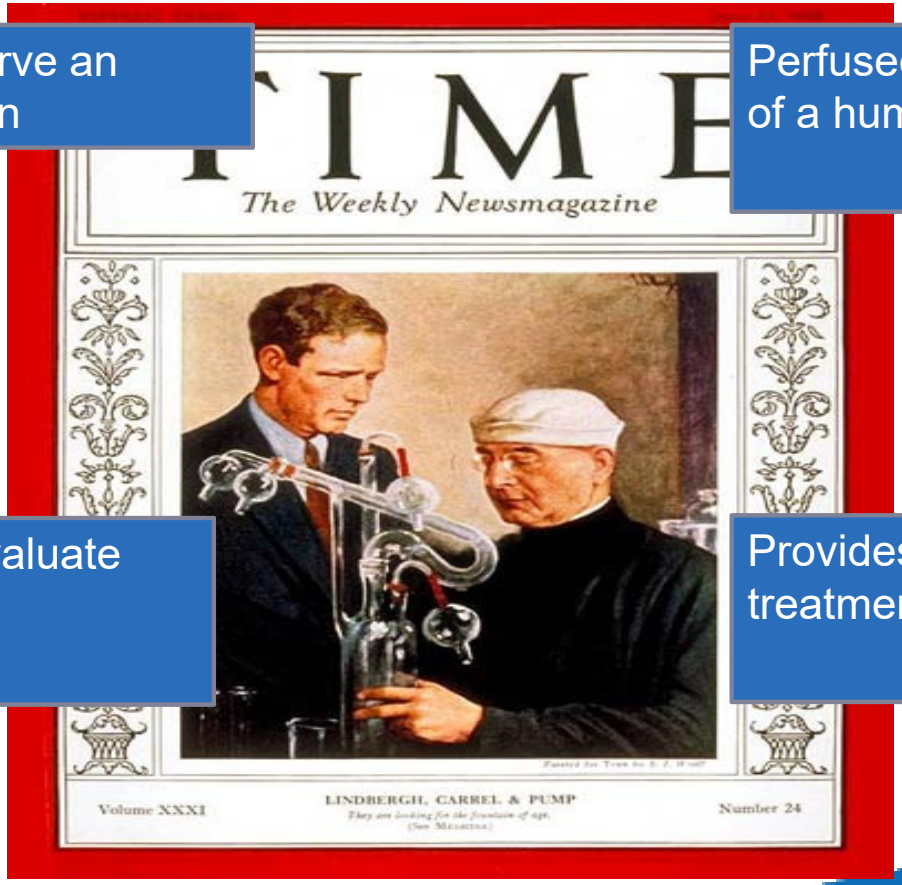

LINDBERGH – NMRI
ORGAN PERFUSION
SYSTEM
AIR BLEED
D
SPHYGMOMONOMETER
F
AIR TRAP
E
A
B
ORGAN
CHAMBER
G
SMALL-DIAMETER PLASTIC TUBE
TO ROTATING VALVE
ONE-WAY
VALVES
DIASTOLIC
PRESSURE
CONTROL
N
H
I
M
Q
P
RETURN
FLOW
BAG
PULSATION
FLASK
MEDIA
DRAIN
CANNULE
O
LARGE-DIAMETER PLASTIC TUBE
J
MEDIA
INJECTION
CANNULE
K
MEDIA
RESERVOIR
BAG
L
PULSATION
FLASK

TIME
The Weekly Newsmagazine
Volume XXXI
LINDBERGH, CARREL & PUMP
Number 24

What is Normothermic Ex Vivo Perfusion

Alternative method to preserve an organ prior to transplantation

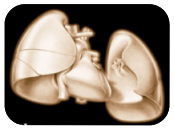
Perfused at normothermia outside of a human body



Allows time to accurately evaluate and diagnose organ

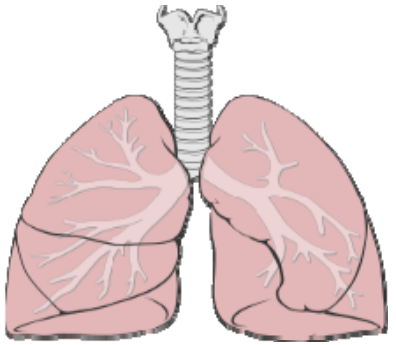
Provides option for targeted treatment, recovery and/or repair

UHN Toronto General Hospital



Chapter One

ExVivo Lung Perfusion (EVLP)



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UHN NEWS

UHN becomes largest adult transplant program in North America

Director of UHN's Multi-Organ Transplant Program, (L) and surgical fellow at Toronto General Hospital in November, 2017. pioneered at TG in 2008.

The lung transplant program – now the largest in the world – performed 167 transplants last year, with about one-third of them due to the innovative Toronto Ex Vivo Lung Perfusion System. This system for high-risk donor lungs, a world-first pioneered at TG in 2008, assesses, improves and treats donor lungs, making many more available for transplant.

This program is now expanding to other organs.

transplants in 2017.

"This propels us into the ranks of the top transplant programs int... the top transplant program in the world," says Dr. Atul Humar, Medical Director of the ... located at Toronto General Hospital. (TG)

"It is not just the experience we have in doing so many transplants, our outcomes are equal to or exceed international standards, even though we take on some of the most complex cases," Dr. Humar said.

UHN
Toronto General
Toronto Western
Princess Margaret
Toronto Rehab
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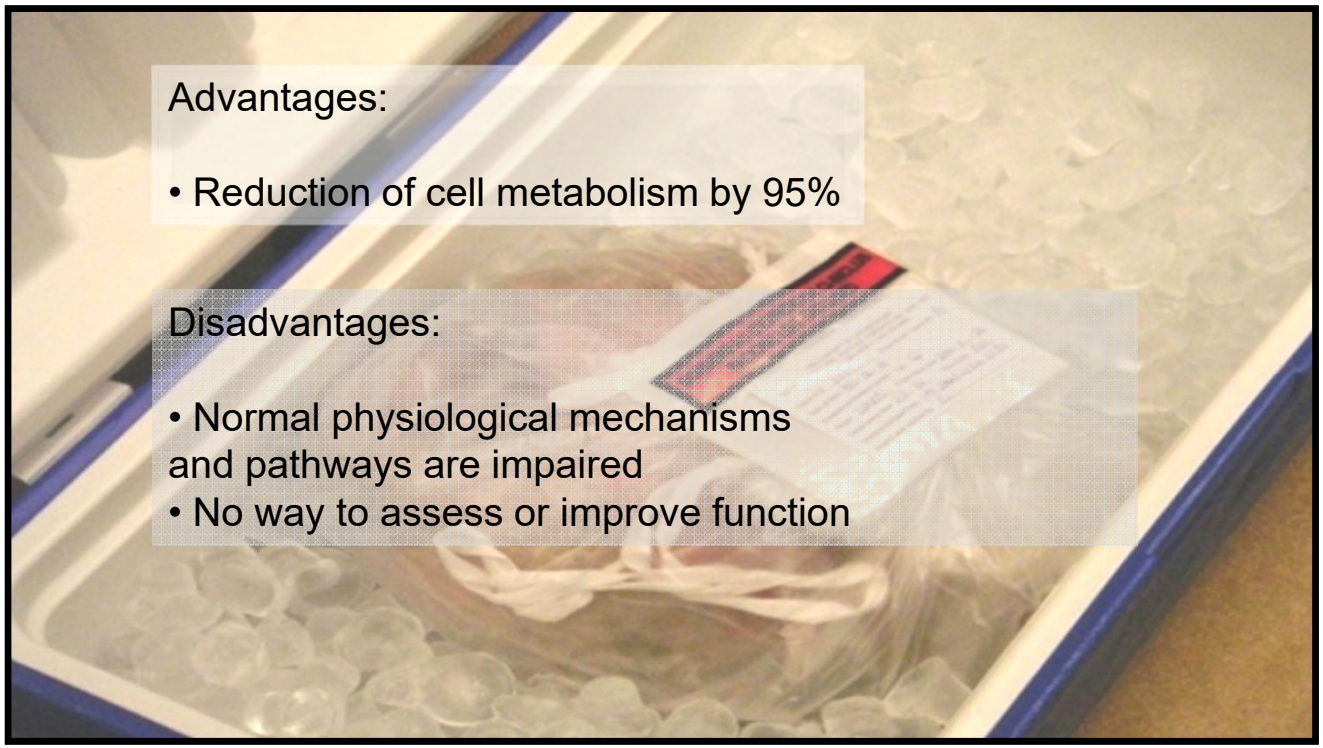
Conventional Cold Storage



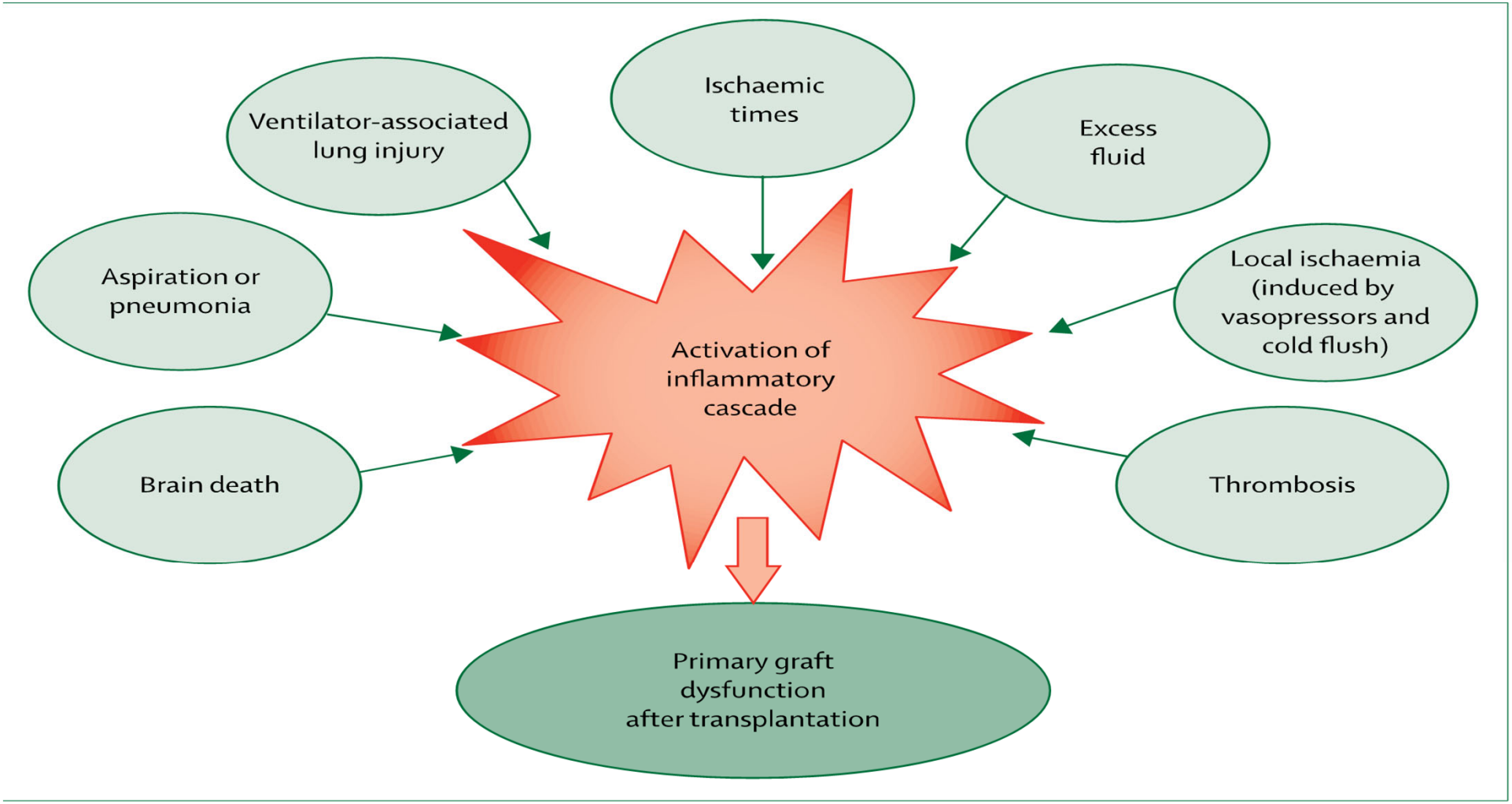


Figure 1: **Injuries to donor lungs in potential multiorgan donors**

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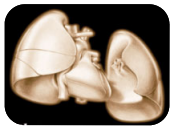
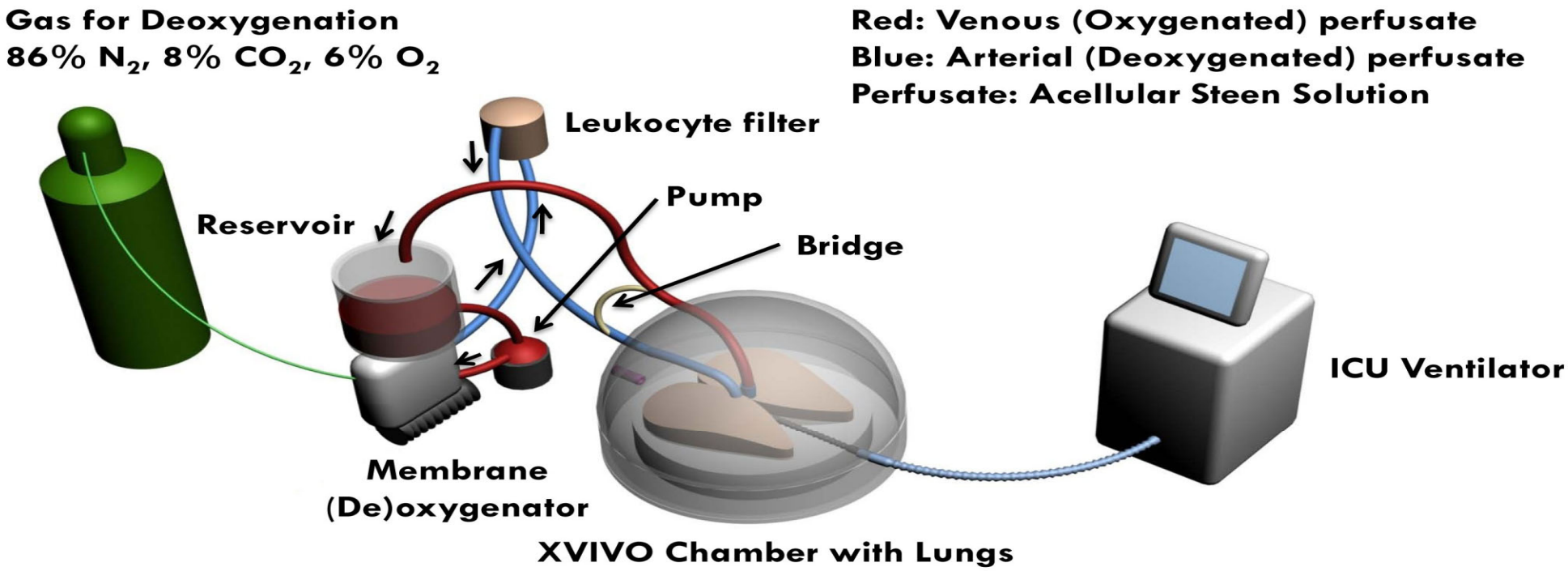
Munshi L, Keshavjee S, Cypel M. The Lancet RM Volume 1, Issue 4, Pages 318 - 328, June 2013



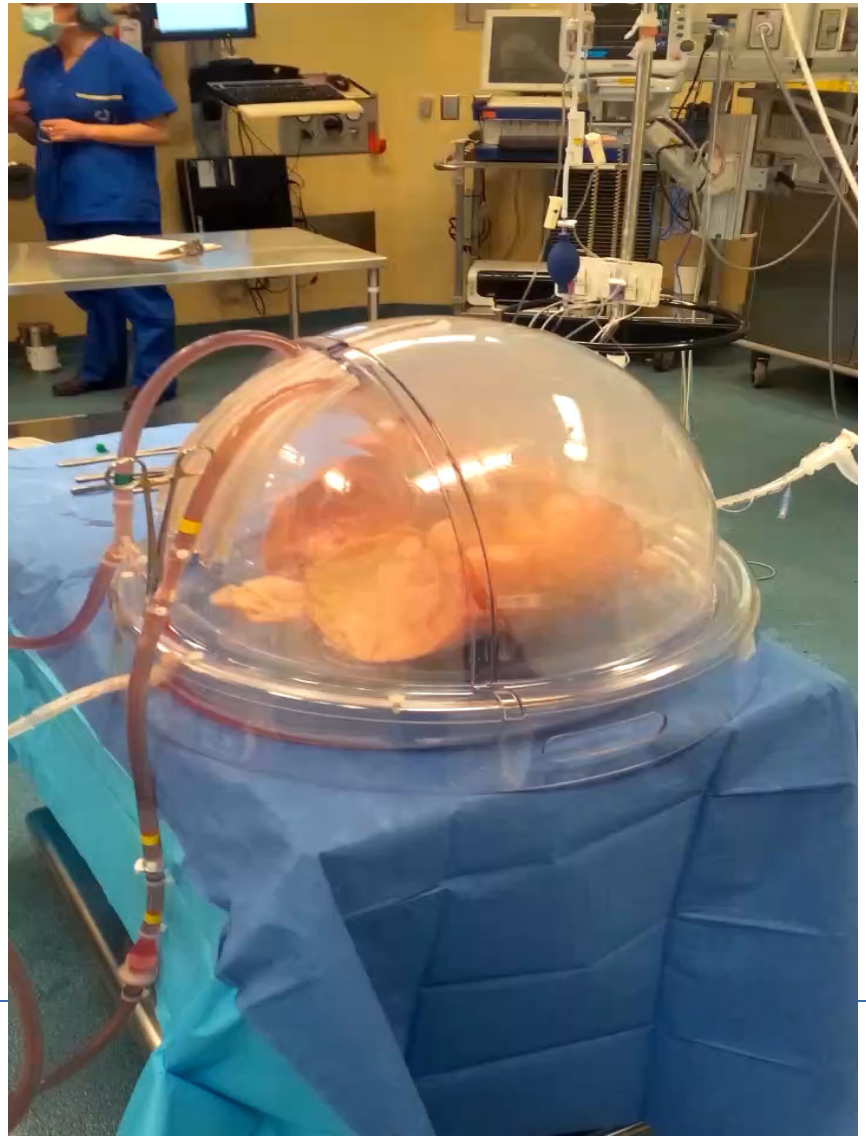
TORONTO EX VIVO LUNG PERFUSION (EVLP) SYSTEM



Perfusion : 40% CO, LAP 5mmHg, PAP 10-12mmHg
Ventilation: 7cc/kg, 7BPM, PEEP 5, FiO_2 = 21%

Cypel et al. J Heart Lung Transplant 2008; 27(12):1319-25.

Health Network



Ex Vivo Lung Perfusion in Lung Transplantation

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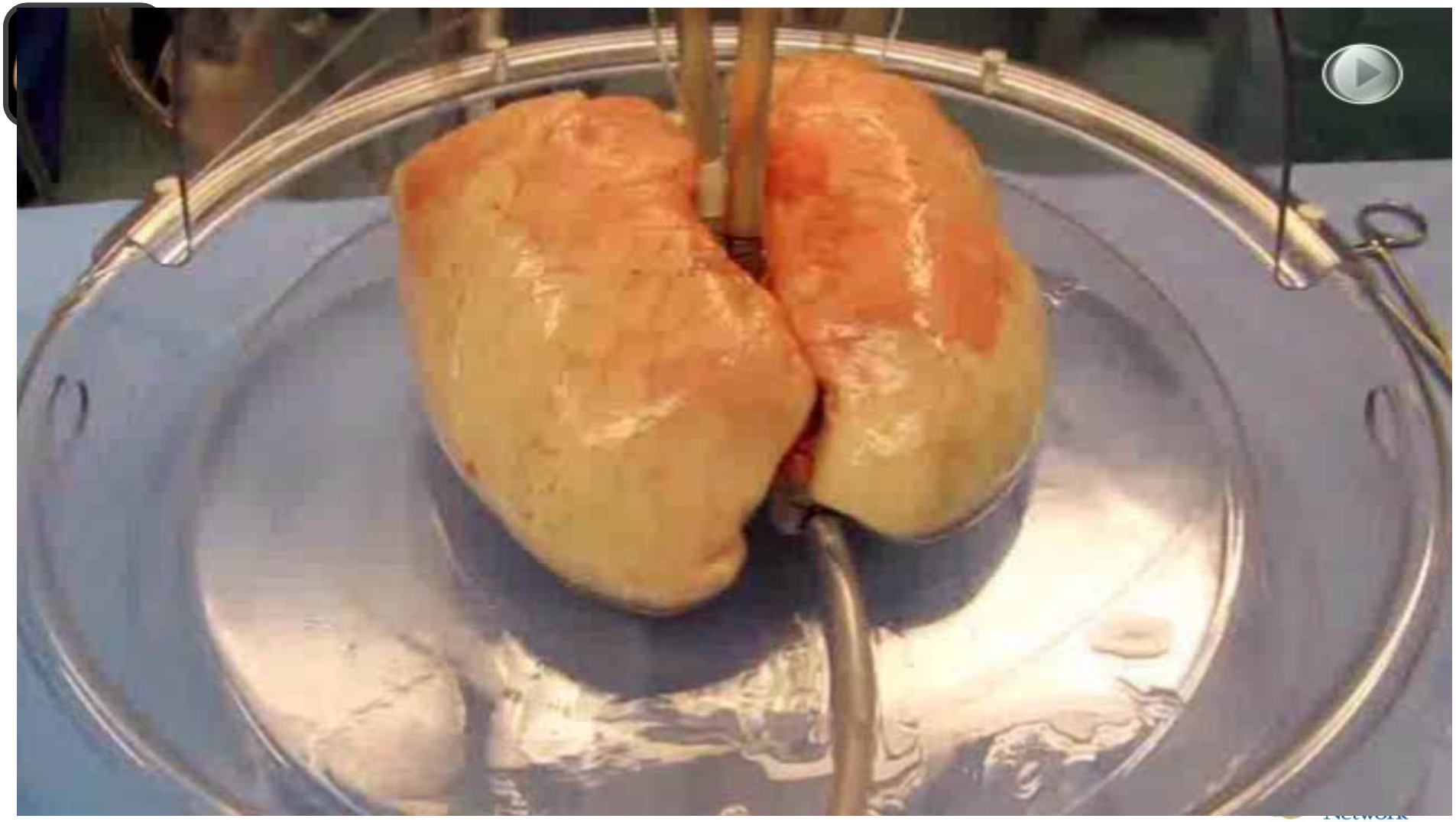
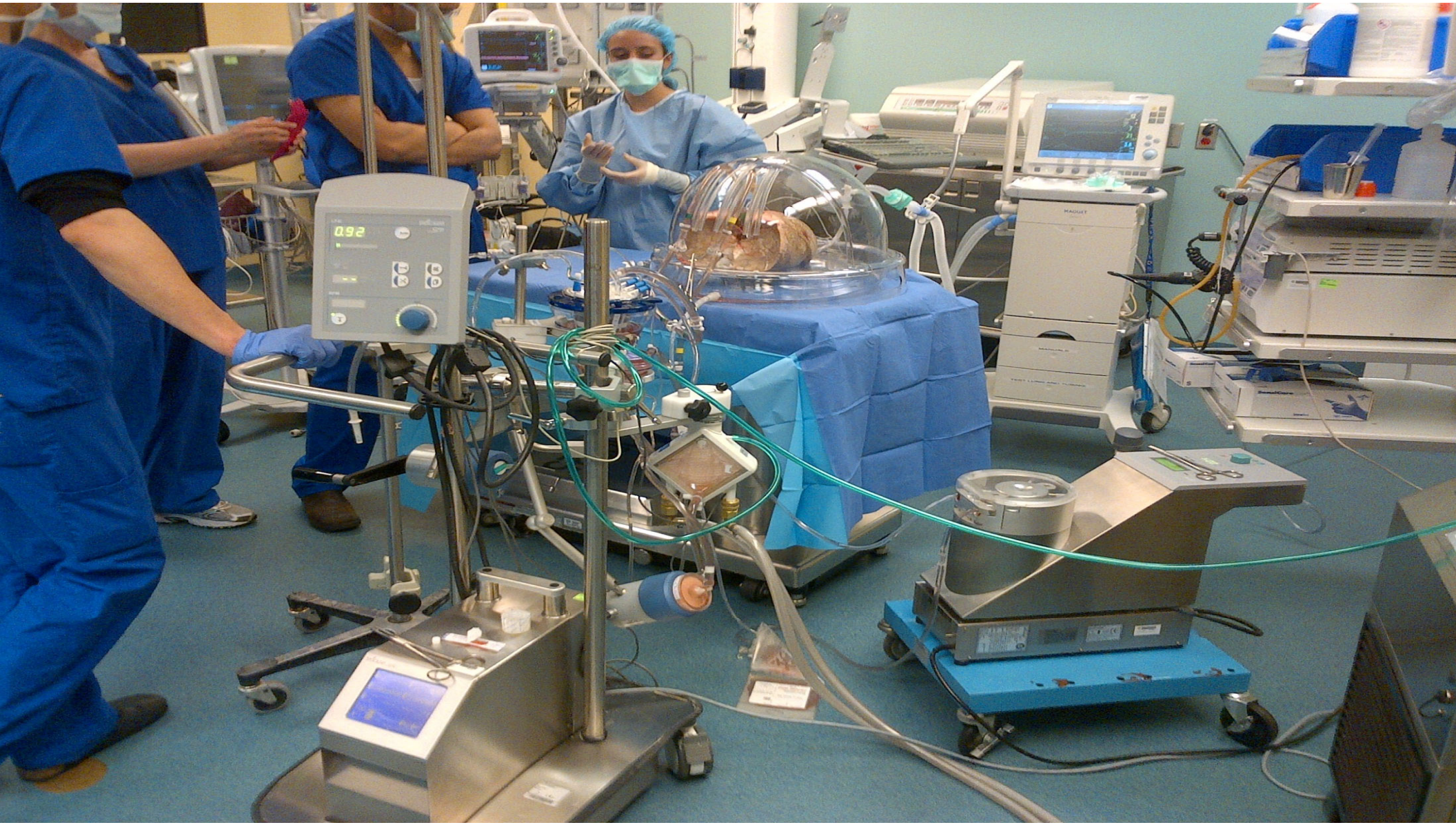
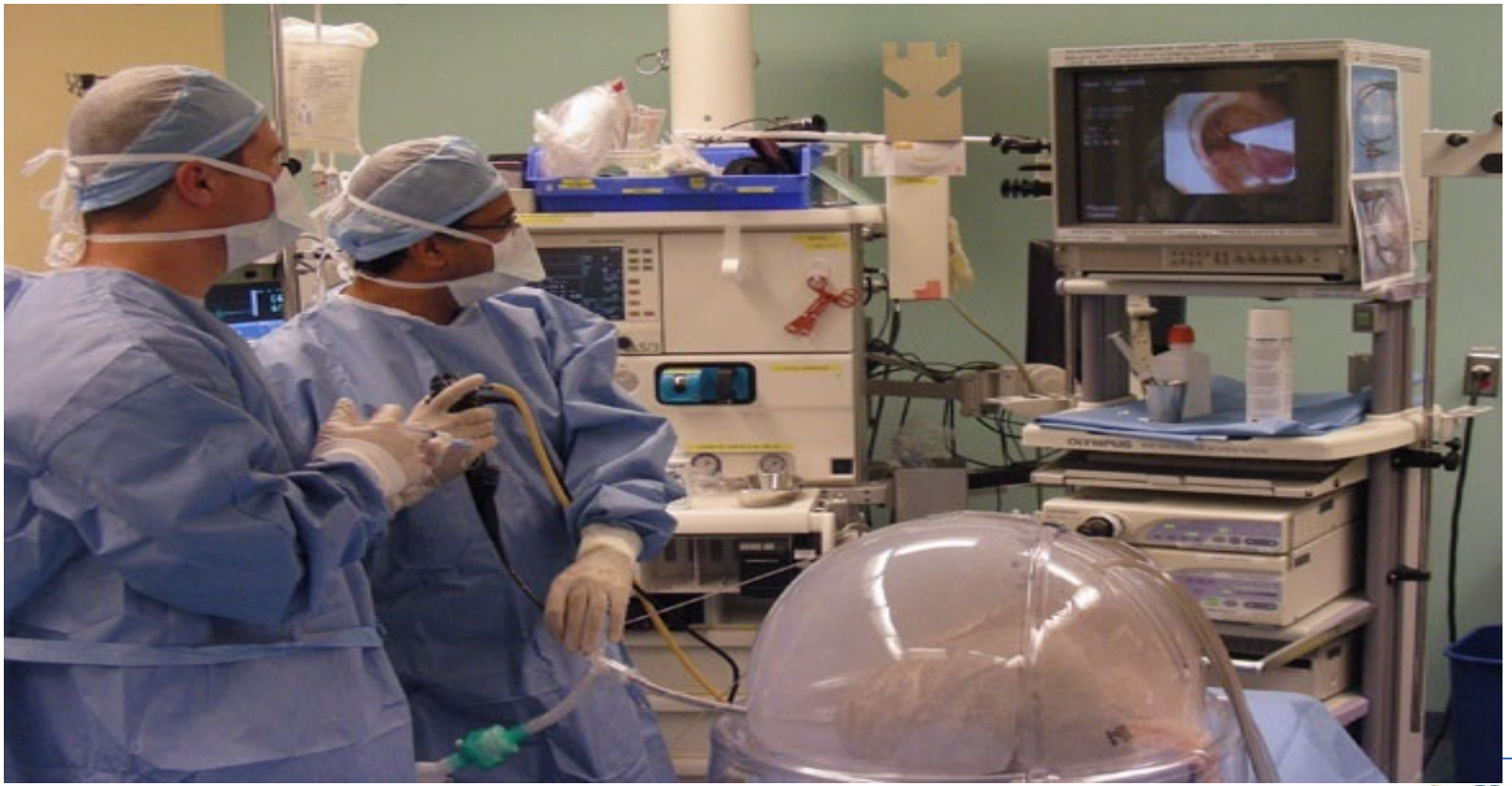




Bronchoscopy



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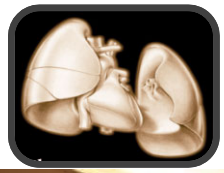
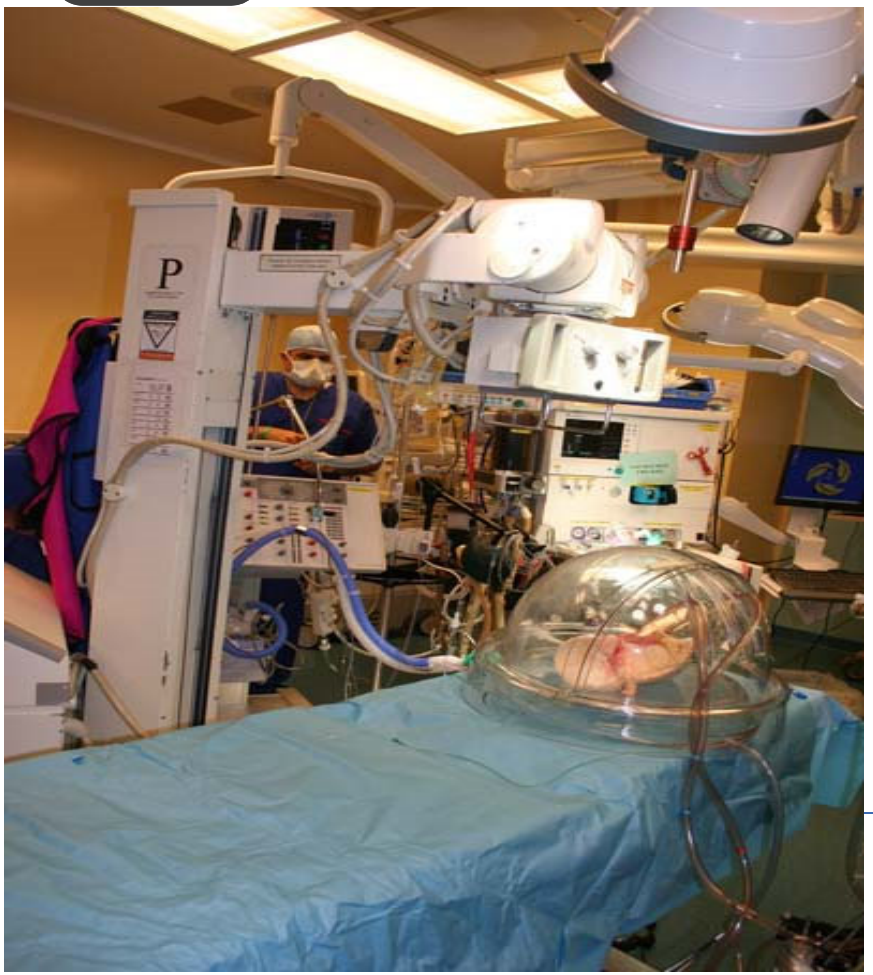


Lung X-ray



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The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Normothermic Ex Vivo Lung Perfusion in Clinical Lung Transplantation

Marcelo Cypel, M.D., Jonathan C. Yeung, M.D., Mingyao Liu, M.D., Masaki Anraku, M.D., Fengshi Chen, M.D., Ph.D., Wojtek Karolak, M.D., Masaaki Sato, M.D., Ph.D., Jane Laratta, R.N., Sassan Azad, C.R.A., Mindy Madonik, C.C.P., Chung-Wai Chow, M.D., Cecilia Chaparro, M.D., Michael Hutcheon, M.D., Lianne G. Singer, M.D., Arthur S. Slutsky, M.D., Kazuhiro Yasufuku, M.D., Ph.D., Marc de Perrot, M.D., Andrew F. Pierre, M.D., Thomas K. Waddell, M.D., Ph.D., and Shaf Keshavjee, M.D.

NEJM, April 14th 2011, vol. 364, no. 15, pp. 1431-1440.

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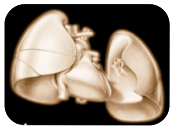


Study Design

Donor Lungs Referred for EVLP

↓

Cold Ischemic Time 1
Transportation

↓

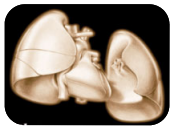
EVLP for 4-6h
P/F>400mmHg, stable or improved PawP, PVR, Compliance, X-ray

↓

Cold Ischemic Time 2

↓

Transplantation



Early outcomes similar in both groups

Table 2. Outcomes in the EVLP and Control Groups.*

End Point	EVLP Lungs (N=20)			Control Lungs (N=116)	Absolute Difference†	P Value‡
	Donors without a Heartbeat (N=9)	Brain-Dead Donors (N=11)	Total (N=20)		*percentage points (95% CI)*	
Primary end point§						
PGD grade 2 or 3 at 72 hr (%)	11	18	15	30	15 (−3 to 33)	0.11
Secondary end points§						
PGD grade 2 or 3 at ICU arrival (%)	33	18	25	30	5 (−15 to 26)	0.30
PGD grade 2 or 3 at 24 hr (%)	11	18	15	36	21 (3 to 39)	0.07
PGD grade 2 or 3 at 48 hr (%)	33	27	30	35	5 (−17 to 27)	0.46
ECMO (%)	0	0	0	4		0.37
PaO_2:FIO_2 on arrival in ICU (mm Hg)						0.51
Median	420	423	422	372		
Range	85–518	86–538	85–538	49–591		
Mechanical ventilation after transplantation (days)						0.15
Median	2	2	2	2		
Range	1–27	1–101	1–101	1–43		
ICU stay after transplantation (days)						0.68
Median	4	5	4	4		
Range	1–34	1–101	1–101	1–103		
Hospital stay after transplantation (days)						0.39
Median	19	34	23	27		
Range	7–54	11–101	7–101	9–156		

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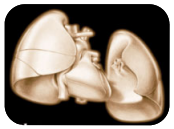
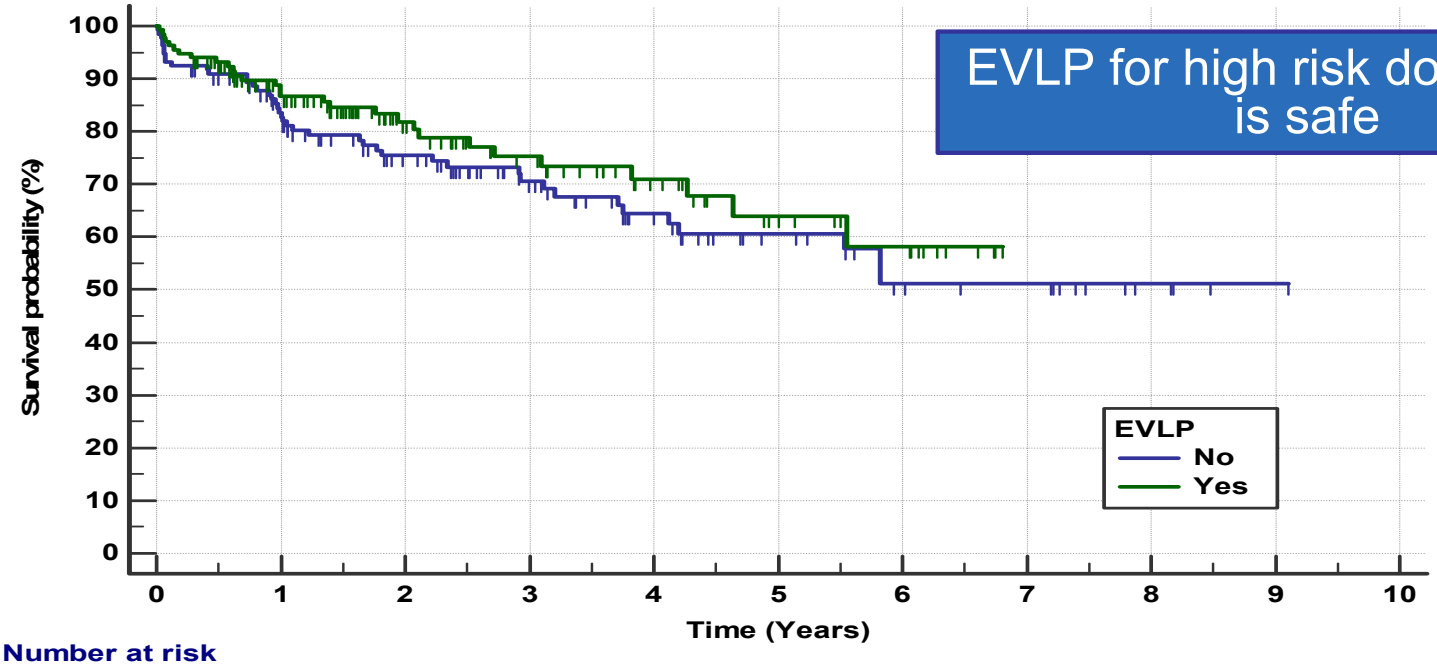
NEJM, April 14th 2011



Survival Probability

133 EVLPs vs. 133 matched controls



EVLP for high risk donor lungs is safe

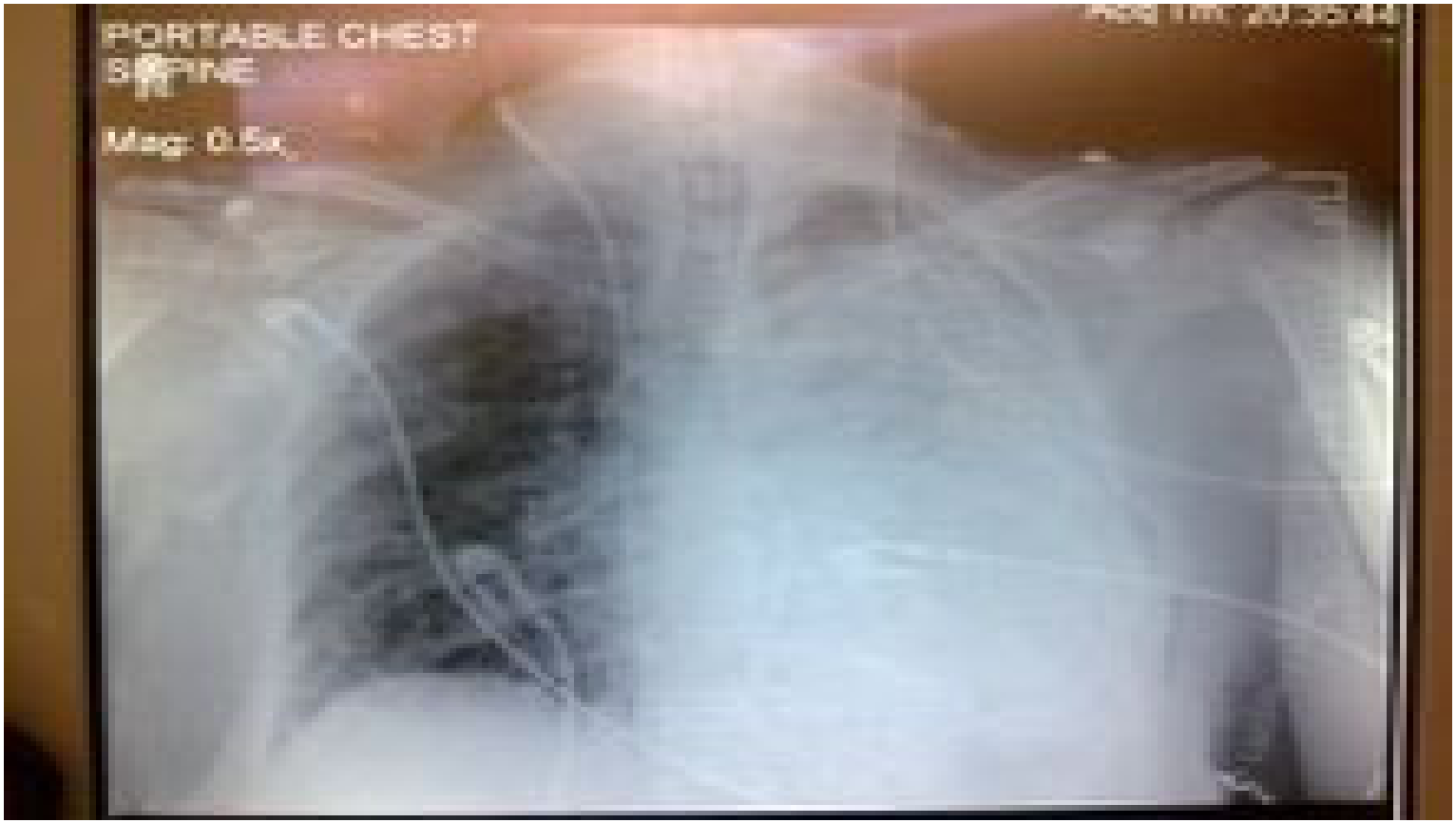
Number at risk

EVLP: No	133	100	73	51	34	23	14	12	5	2	0
EVLP: Yes	133	89	55	40	26	14	10	0	0	0	0

Yeung, J. JHLT 2016

University Health Network

Clinical Problem - PGD



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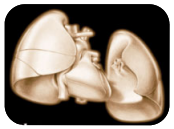

EVLP is associated with decreased rates of PGD

Category	No EVLP (n=133)	EVLP (n=133)	p
Hospital LOS (Median, IQR)	23 (16.5-43)	21 (16-34)	0.21
ICU LOS (Median, IQR)	4 (2-14.5)	4 (2-10.5)	0.83
ISHLT PGD at 72h			0.02
0	82 (61.7%)	92 (69.2%)	
1	8 (6.0%)	18 (13.5%)	
2	30 (22.6%)	14 (10.5%)	
3	12 (9.0%)	9 (6.8%)	

Yeung. J, JHLT 2016

Table 1.3: ISHLT PGD Grading[87]

Grade	P/F ratio	Chest x-ray
0	› 300	Normal
1	› 300	Diffuse allograft infiltrates
2	200-300	Diffuse allograft infiltrates
3	‹ 200	Diffuse allograft infiltrates

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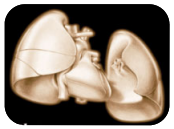
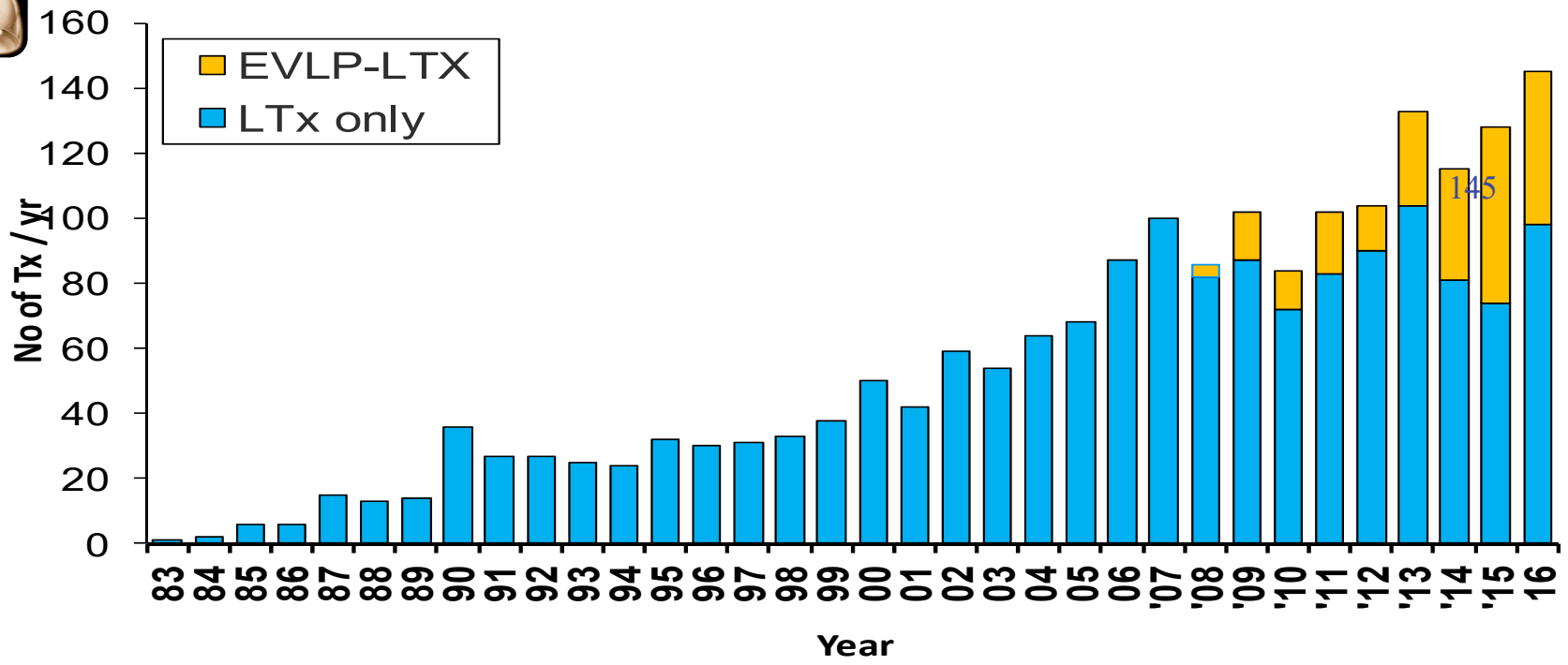
Yeung, J. 2011

Impact of EVLP on Lung Tx Program





Year	Cases	Used	%	% Lung Tx
2018-19	127	86	68%	38%
2019-20	123	77	61%	30%

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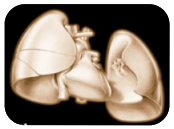

EVLP Industry

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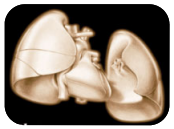
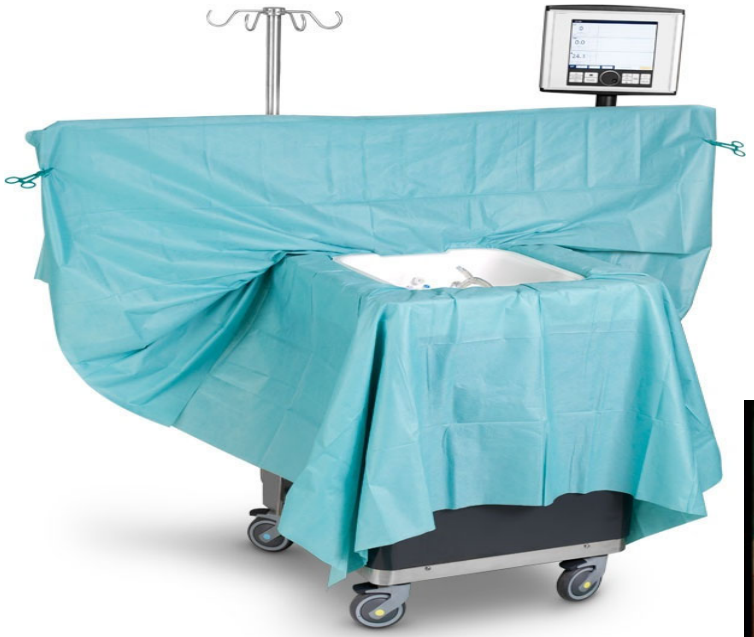
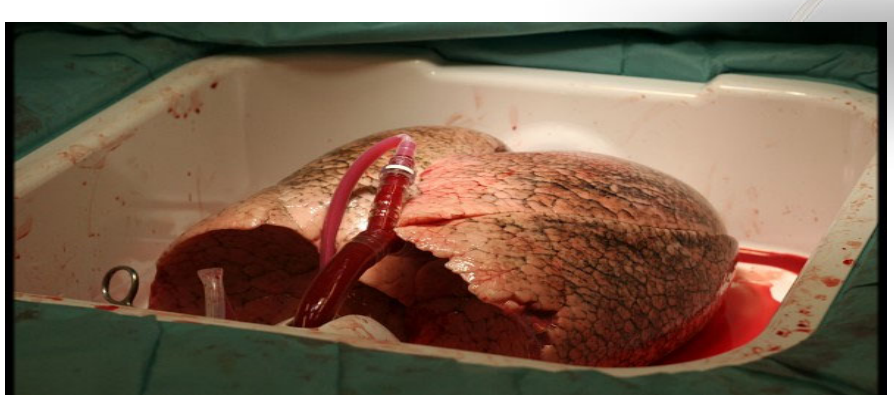


Vivoline





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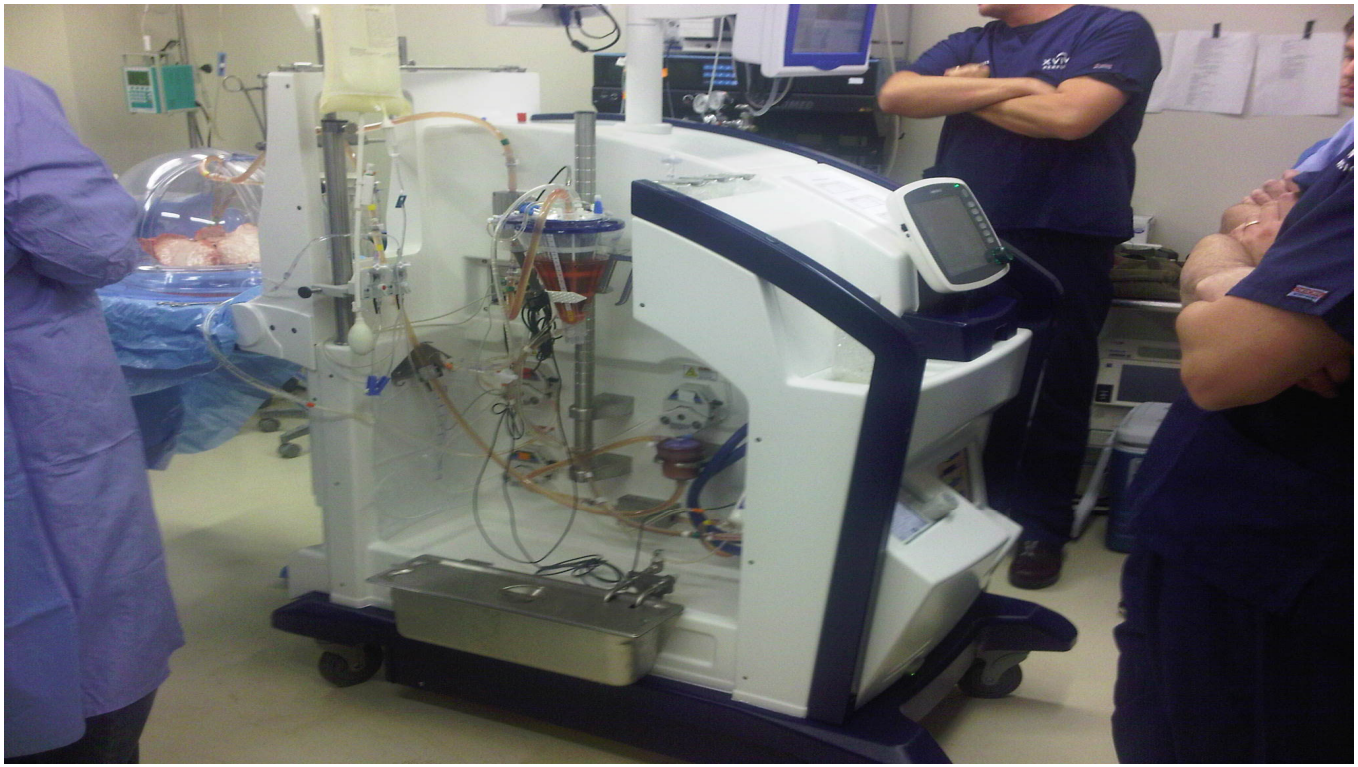
XVIVO Perfusion Inc.



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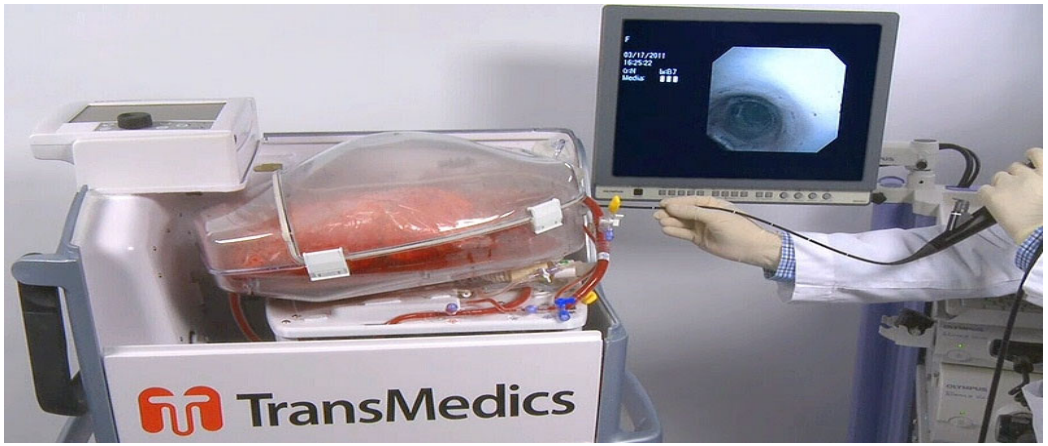
TransMedics



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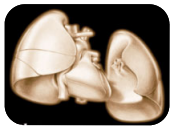


Perfusion Protocols

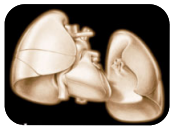
	Toronto	Lund (Vivoline)	Organ Care System
Perfusion			
Target total	40% cardiac output (1 h)	100% cardiac output (1 h)	2·5 L (15–30 min)
Start rate	150 mL/min	100 mL/min	200 mL/min
Pulmonary arterial pressure	<15 mm Hg	<20 mm Hg*	<20 mm Hg
Left atrial pressure	3–5 mm Hg	0 mm Hg	0 mm Hg
Pump	Centrifugal	Roller	Pulsatile
Perfusate	2 L Steen solution	2 L Steen solution plus red blood cells (haematocrit 10%)	1·5 L Steen solution plus red blood cells (haematocrit 20%)
Ventilation			
Mode	Volume controlled	Volume controlled	Volume controlled
Tidal volume	7 mL/kg	5–7 mL/kg	6 mL/kg
Frequency	7 bpm	20 bpm	10 bpm
Positive end-expiratory pressure	5 cm H_2O	5 cm H_2O	5 cm H_2O
Fraction of inspired oxygen	21%	50%	21%
Temperature			
Start ventilation	32°C	32°C	32°C
Start perfusion	25°C	25°C	32°C
Start evaluation	37°C	37°C	37°C
Perfusion time	12 h	2 h	Duration of transport†

*Pulmonary arterial pressure of <15 mm Hg used in pigs. †Mean time of 5 h in pilot study (range 3–10).[78]

Table 2: **Ex-vivo lung perfusion protocols**

Munshi L, Keshavjee S, Cypel M **Donor management and lung preservation for lung transplantation** The Lancet Respiratory Medicine, 2013, 1(4);318 - 328,

University Health Network



Exvivo treatment opportunities

1- Pulmonary Edema

2- Brain death associated inflammation

3- Infection, Pneumonia

4- Aspiration

5- Pulmonary emboli

6- Ischemia-reperfusion injury

7- Immunologic preparation

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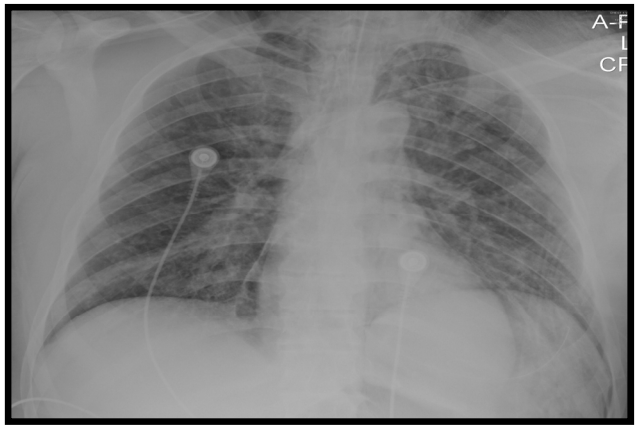
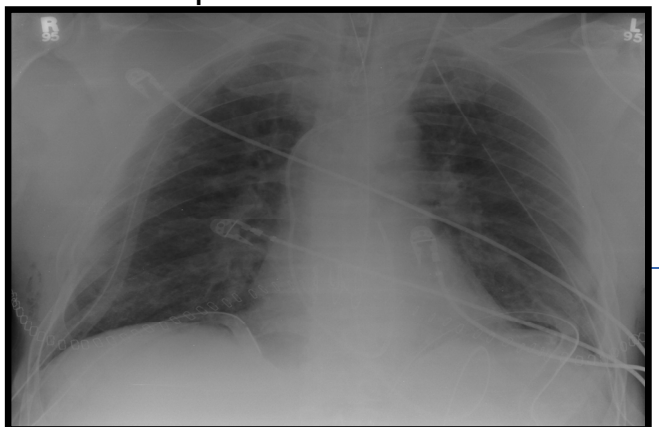
Resolution of pulmonary edema

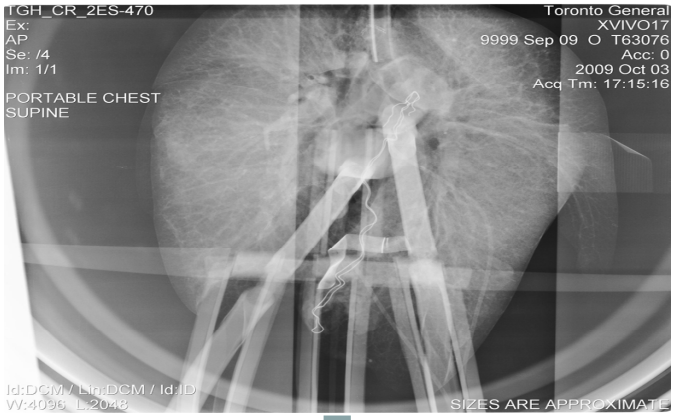
Donor P/F 230



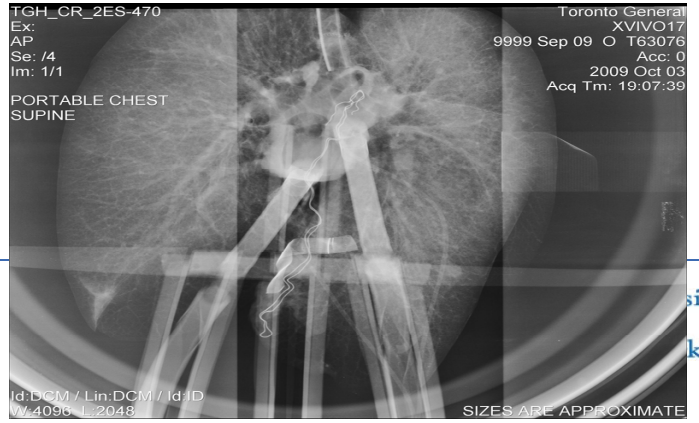
Recipient P/F 420

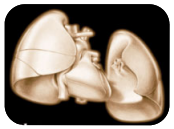


1h EVLP



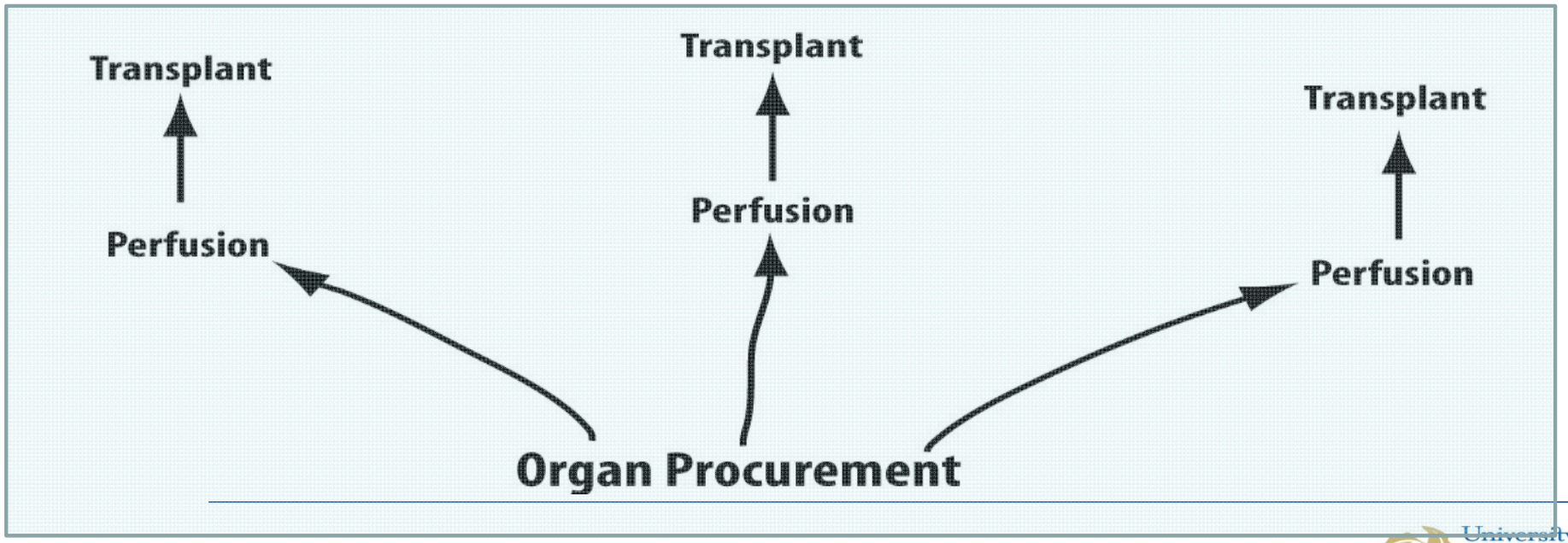
3h EVLP





Conventional Model of Organ Procurement

- Transplant Center - Centric Model



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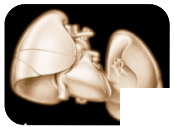

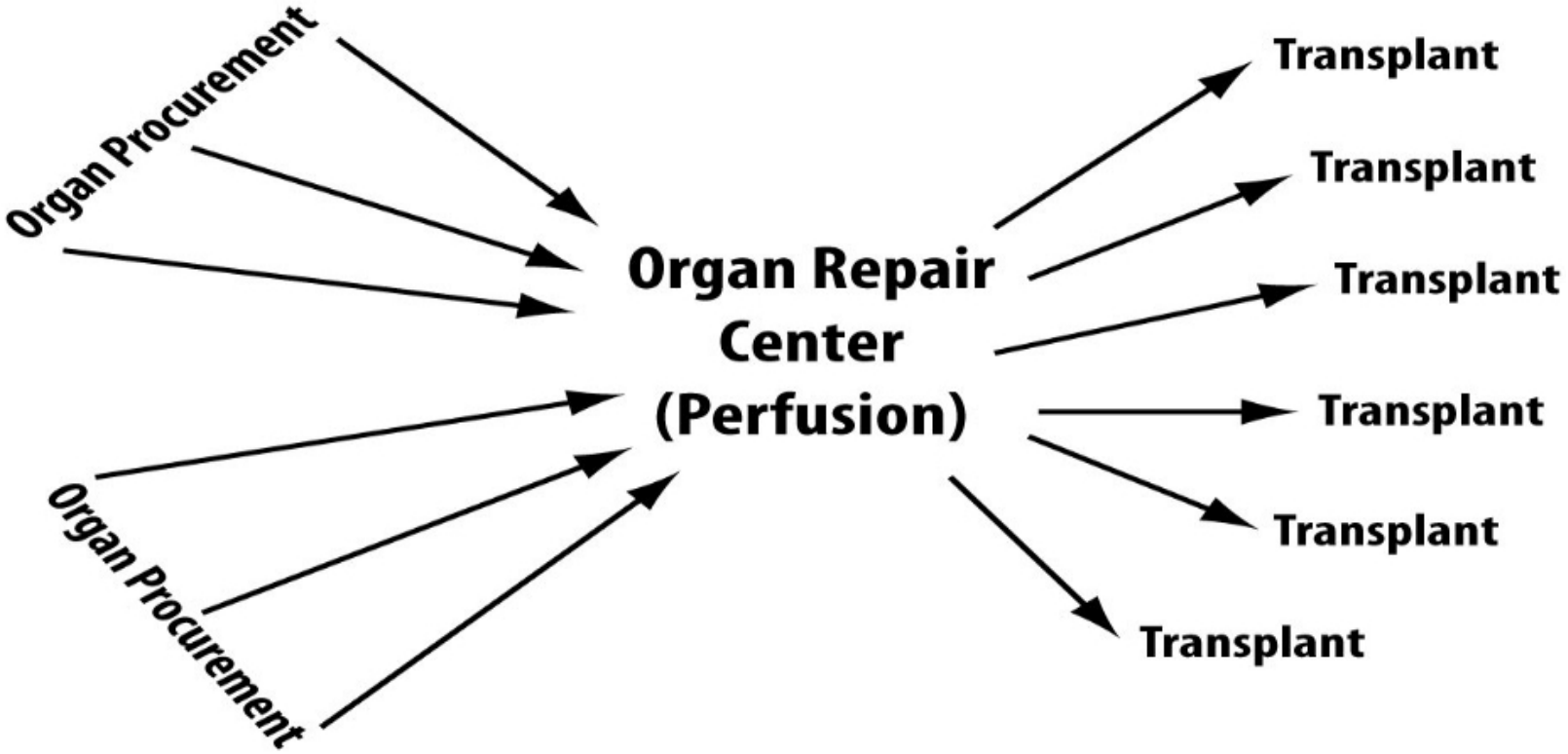

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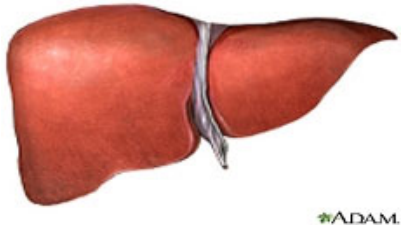
Chapter Two

EXVIVO LIVER PERFUSION SYSTEM



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Jul 28, 2015

UHN Toronto General Hospital perform first liver transplant with the OrganOx *metra*

UHN Toronto General Hospital, Dr David Grant and Dr Markus Selzner have announced the first liver transplant at UHN using the OrganOx *metra*

Press:


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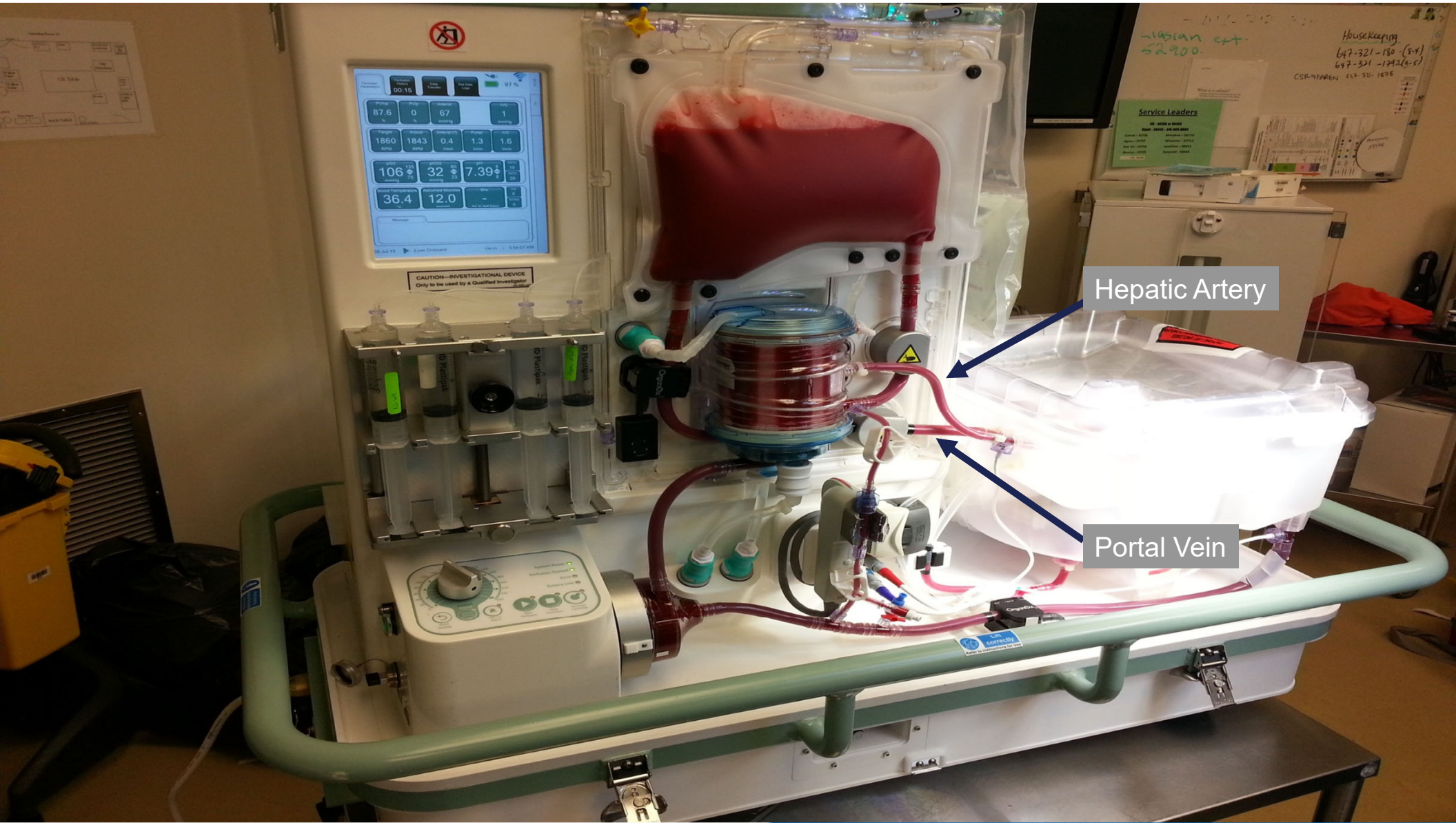
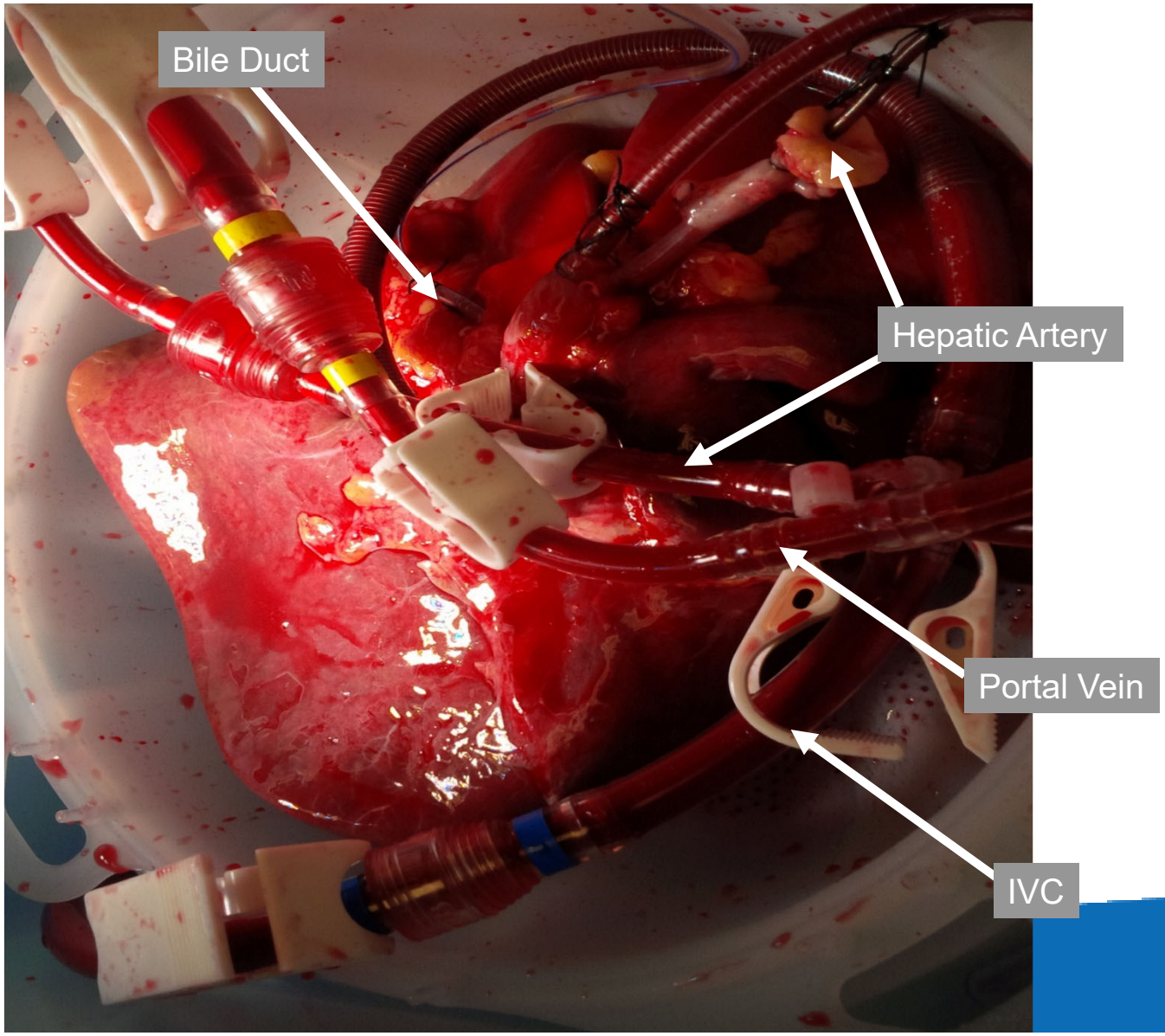

Hepatic Artery
Portal Vein
CAUTION—INVESTIGATIONAL DEVICE
Only to be used by a Qualified Investigator
Service Leaders



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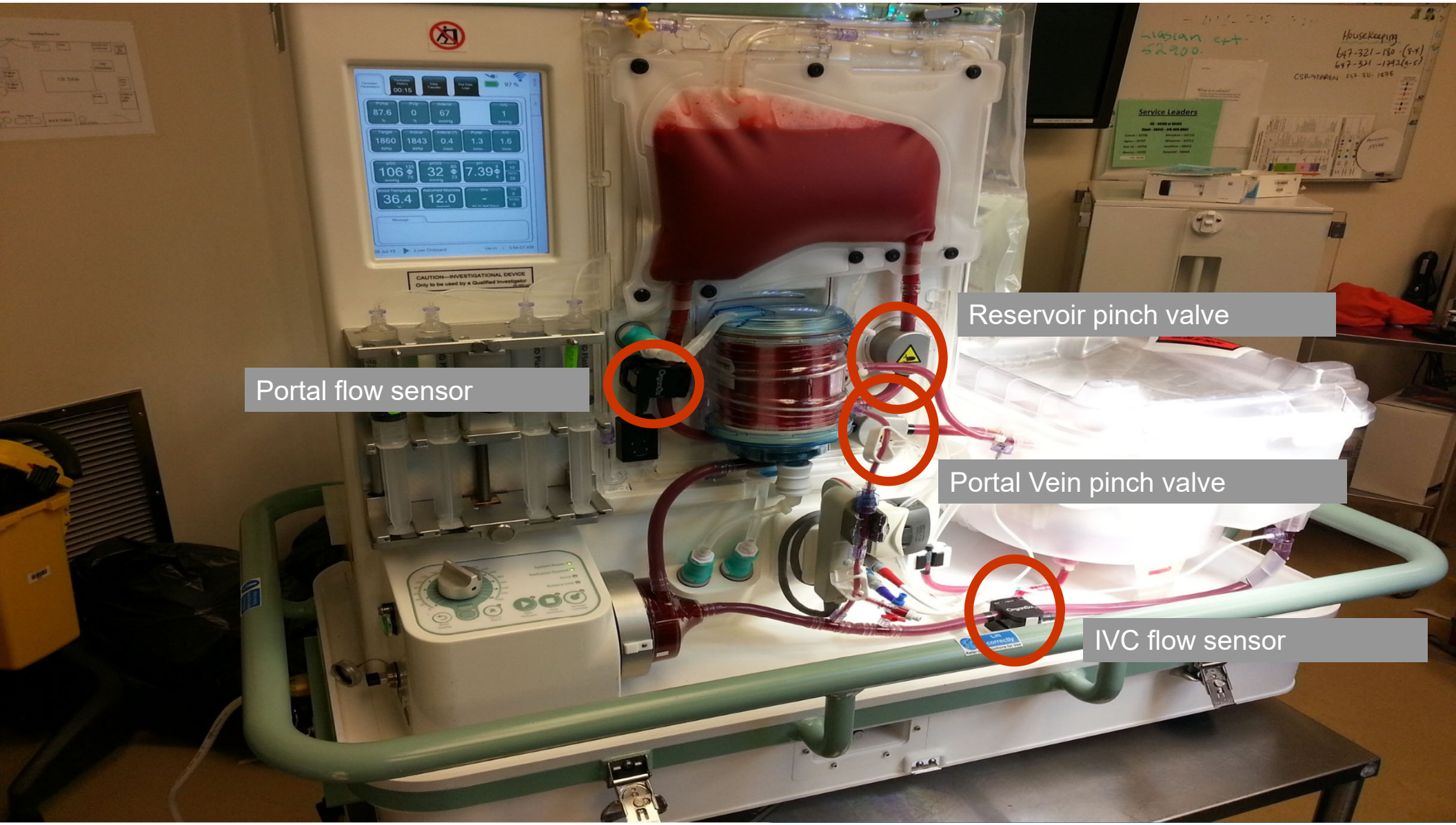
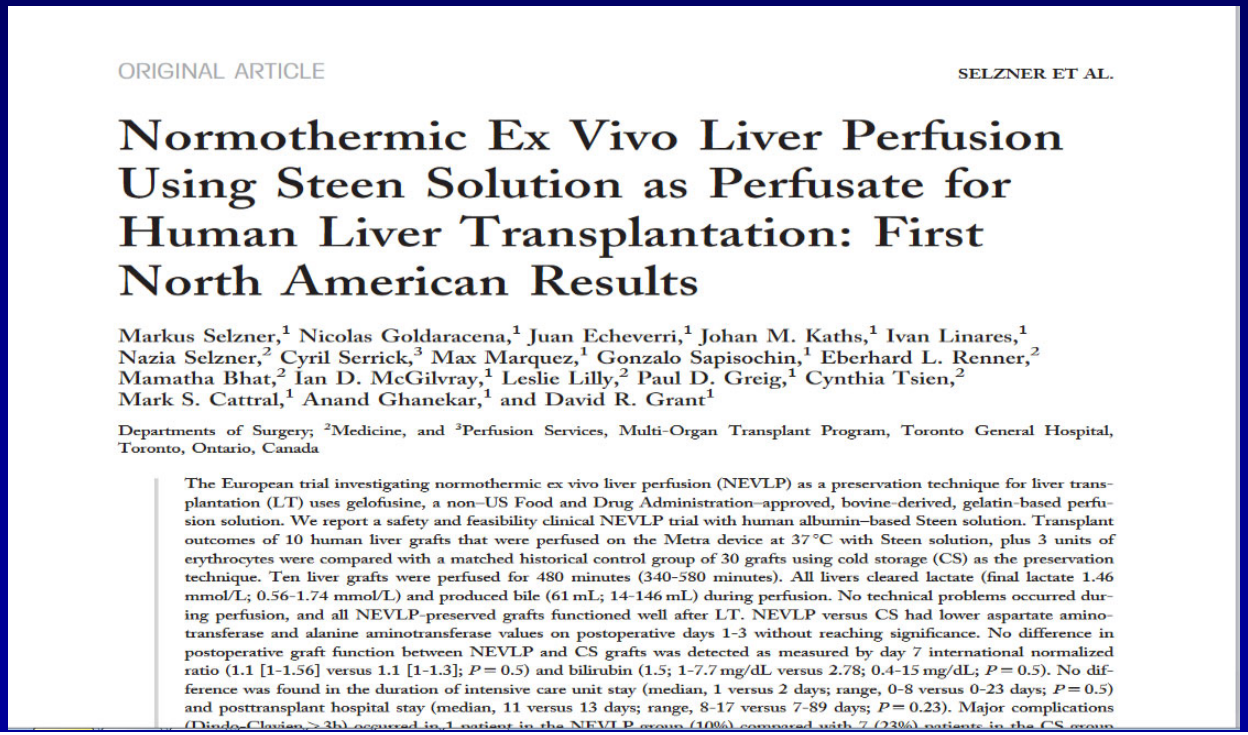

Portal flow sensor
Reservoir pinch valve
Portal Vein pinch valve
IVC flow sensor

Clinical Trial Normothermic Ex Vivo Liver Perfusion in Toronto



ORIGINAL ARTICLE

SELZNER ET AL.

Normothermic Ex Vivo Liver Perfusion Using Steen Solution as Perfusate for Human Liver Transplantation: First North American Results

Markus Selzner,[1] Nicolas Goldaracena,[1] Juan Echeverri,[1] Johan M. Kaths,[1] Ivan Linares,[1] Nazia Selzner,[2] Cyril Serrick,[3] Max Marquez,[1] Gonzalo Sapisochin,[1] Eberhard L. Renner,[2] Mamatha Bhat,[2] Ian D. McGilvray,[1] Leslie Lilly,[2] Paul D. Greig,[1] Cynthia Tsien,[2] Mark S. Cattral,[1] Anand Ghanekar,[1] and David R. Grant[1]

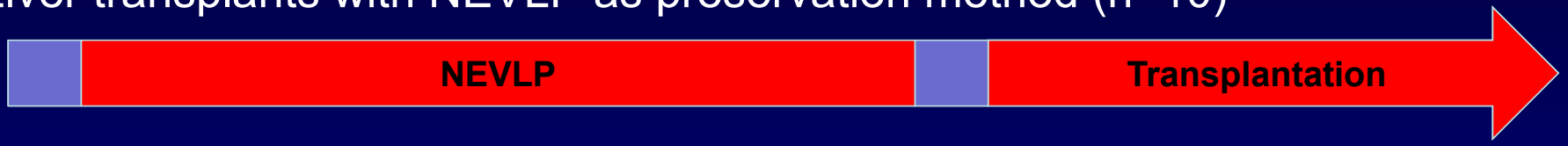
Departments of Surgery; [2]Medicine, and [3]Perfusion Services, Multi-Organ Transplant Program, Toronto General Hospital, Toronto, Ontario, Canada

The European trial investigating normothermic ex vivo liver perfusion (NEVLP) as a preservation technique for liver transplantation (LT) uses gelofusine, a non–US Food and Drug Administration–approved, bovine-derived, gelatin-based perfusion solution. We report a safety and feasibility clinical NEVLP trial with human albumin–based Steen solution. Transplant outcomes of 10 human liver grafts that were perfused on the Metra device at 37 °C with Steen solution, plus 3 units of erythrocytes were compared with a matched historical control group of 30 grafts using cold storage (CS) as the preservation technique. Ten liver grafts were perfused for 480 minutes (340-580 minutes). All livers cleared lactate (final lactate 1.46 mmol/L; 0.56-1.74 mmol/L) and produced bile (61 mL; 14-146 mL) during perfusion. No technical problems occurred during perfusion, and all NEVLP-preserved grafts functioned well after LT. NEVLP versus CS had lower aspartate aminotransferase and alanine aminotransferase values on postoperative days 1-3 without reaching significance. No difference in postoperative graft function between NEVLP and CS grafts was detected as measured by day 7 international normalized ratio (1.1 [1-1.56] versus 1.1 [1-1.3]; $P = 0.5$) and bilirubin (1.5; 1-7.7 mg/dL versus 2.78; 0.4-15 mg/dL; $P = 0.5$). No difference was found in the duration of intensive care unit stay (median, 1 versus 2 days; range, 0-8 versus 0-23 days; $P = 0.5$) and posttransplant hospital stay (median, 11 versus 13 days; range, 8-17 versus 7-89 days; $P = 0.23$). Major complications (Dindo-Clavien ≥ 3b) occurred in 1 patient in the NEVLP group (10%) compared with 7 (23%) patients in the CS group

Methods

Match control study design 1:3

- Liver transplants with NEVLP as preservation method (n=10)



- Control group:
  Liver transplants with CS as preservation method (n=30)

- Matched for
  - donor type (DCD vs BDD)
  - medical MELD (severity of liver disease)
  - donor and recipient age
  - preservation time
- 3 months follow-up
- Exclusion: fulminant liver failure, multiorgan transplant

Results

TABLE 3. Graft Function and Injury After Transplantation

	NEVLP (n = 10)	CS (n = 30)	*P* Value
ALT peak 48 hours, U/L	619 (55-2858)	949 (233-3073)	0.55
INR peak	2.6 (2-4.4)	2.7 (1.7-5.8)	0.61
INR 1 week	1.1 (1-1.56)	1.1 (1-1.3)	0.47
INR 3 month	1 (1-2)	1 (1-2)	0.91
Bilirubin 1 week, mg/dL	1.5 (1.0-7.7)	2.78 (0.4-15)	0.49
Bilirubin 3 month, mg/dL	0.4 (0.2-0.8)	0.6 (0.2-18)	0.21
ALP 1 week, U/L	202 (96-452)	147 (87-456)	0.21
ALP 3 month, U/L	111 (101-136)	132 (54-657)	0.33
Creatinine 1 week, mg/dL	1.0 (0.5-2.0)	0.9 (0.5-2.3)	0.76
Creatinine 3 month, mg/dL	1.1 (0.9-2.4)	1.1 (0.3-1.8)	0.53

NOTE: Data are provided as median and range.

Selzner M, Liver Transpl 2016

First randomized clinical trial for NEVLP

- Peter Friend et al. presented outcomes of 121 NEVLP vs 101 CS transplants.
- Primary outcome was difference in peak AST within 7 days after transplantation
- Secondary outcomes were organ utilization, preservation time, post-reperfusion syndrome, EAD and graft and patient survival

Peter Friend et al. 2017 at International Liver Transplantation Society conference

Primary outcome

DBD	NEVLP (n=87)	SCS(n=80)	Reduction	p-value
Peak AST (DBD)	526.2 (424.9-651.5)	880.2 (795.2-1192.3)	40.2%	p<0.001

DCD	NEVLP (n=33)	SCS (n=20)	Reduction	p-value
Peak AST (DCD)	389.7 (286.7-529.9)	1458.1 (913.4-2327.6)	73.3%	p<0.001

Peter Friend et al. 2017 at International Liver Transplantation Society conference

Secondary outcomes

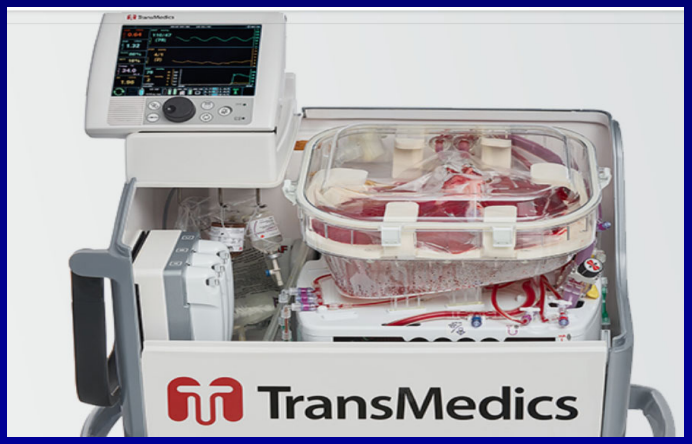
	NEVLP	SCS	P-value
Transplanted	121	101	
Discarded	16 (11.7%)	32 (24.1%)	p=0.008
Grafts with moderate or severe steatosis	29 (24%)	12 (11.9%)	p=0.019
Total preservation time	11hrs 20mins	7hrs 9mins	p<0.0001
Machine perfusion time	10hrs 8mins		
Post-reperfusion syndrome	15 (12.4%)	29 (33%)	p=0.0002
Early Allograft Dysfunction (EAD)	12 (10.1%)	29 (29.9%)	p=0.0002

Peter Friend et al. 2017 at International Liver Transplantation Society conference

Clinical Trials:
Normothermic Ex Vivo Liver Perfusion

Organox/ Metra

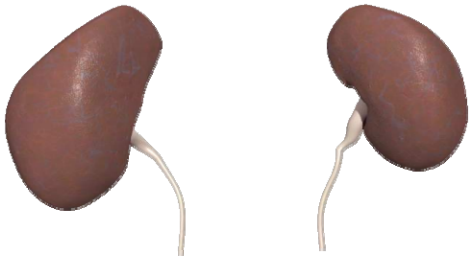
TransMedics OCS Liver



LiverAssist

Chapter Three

Normothermic Exvivo Kidney Perfusion



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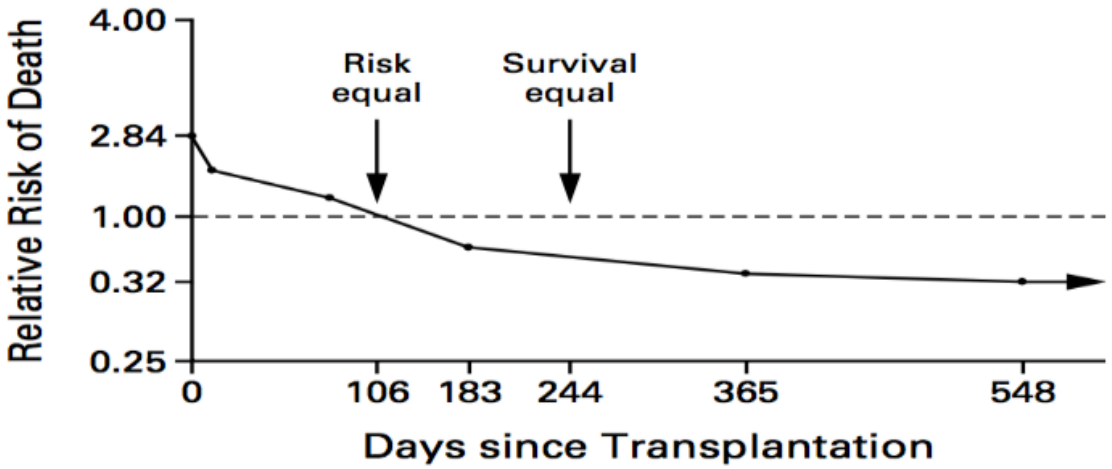
Kidney Transplantation

Kidney transplantation vs. dialysis

- Longer patient survival
- Reduced patient morbidity
- Better quality of life (freedom from dialysis, increased energy, less diet restrictions)
- Improved cost-effectiveness

→ **Kidney transplantation is the treatment of choice for end-stage renal disease (ESRD)**



Wolfe, R. A. et al. (1999) NEJM, *341*(23), 1725–1730.
Meier-Kriesche et al. (2000) *Kidney Int*, *58*(3), 1311–1317.

Problem: Outcome DCD

Effect of donor age and cold storage time on outcome in recipients of kidneys donated after circulatory death in the UK: a cohort study

Dominic M Summers, Rachel J Johnson, Alex Hudson, David Collett, Christopher J Watson, J Andrew Bradley

Outcome

- 3 year graft survival not different between DCD and DBD (HR 1.14, p = 0.16)
- Donor age older than 60 years associated with increased risk of graft loss for both groups (HR 2.35, p < 0.0001) (no difference between the groups)
- Prolonged cold ischemic time (>24h vs. <12h) associated with poorer graft survival for kidneys from DCD donors compared to DBD donors (HR 2.36, p = 0.004)
- Higher delayed graft function rate (DGF) in DCD transplants compared to DBD transplants (OR 3.08, p < 0.0001)

Summers et al. (2013) Lancet

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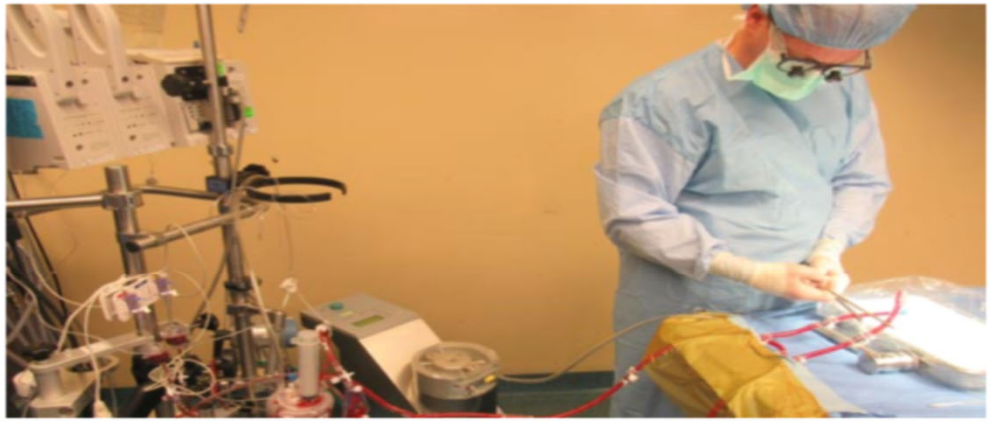
Device keeps donor kidneys healthy outside the body until transplant

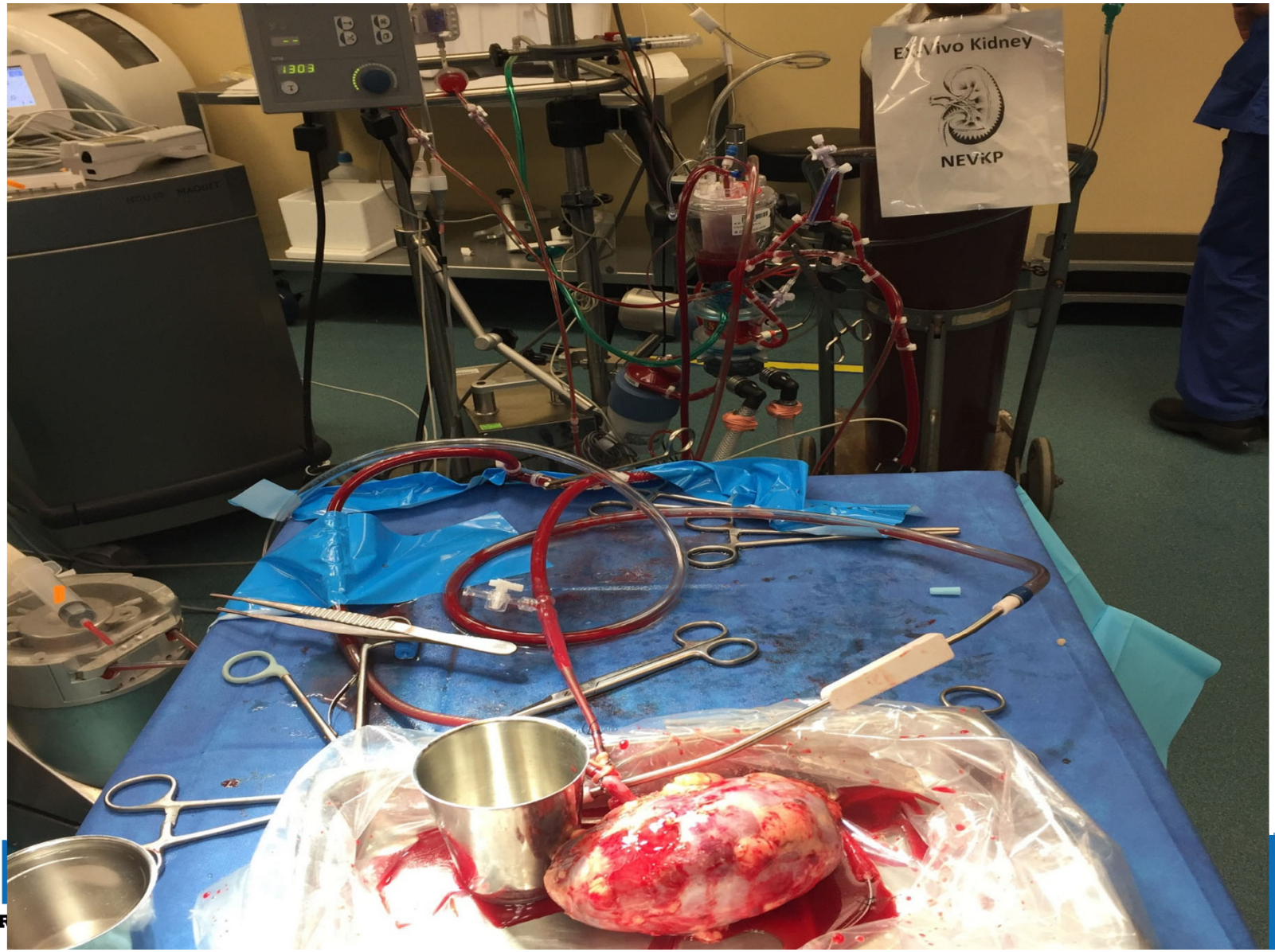


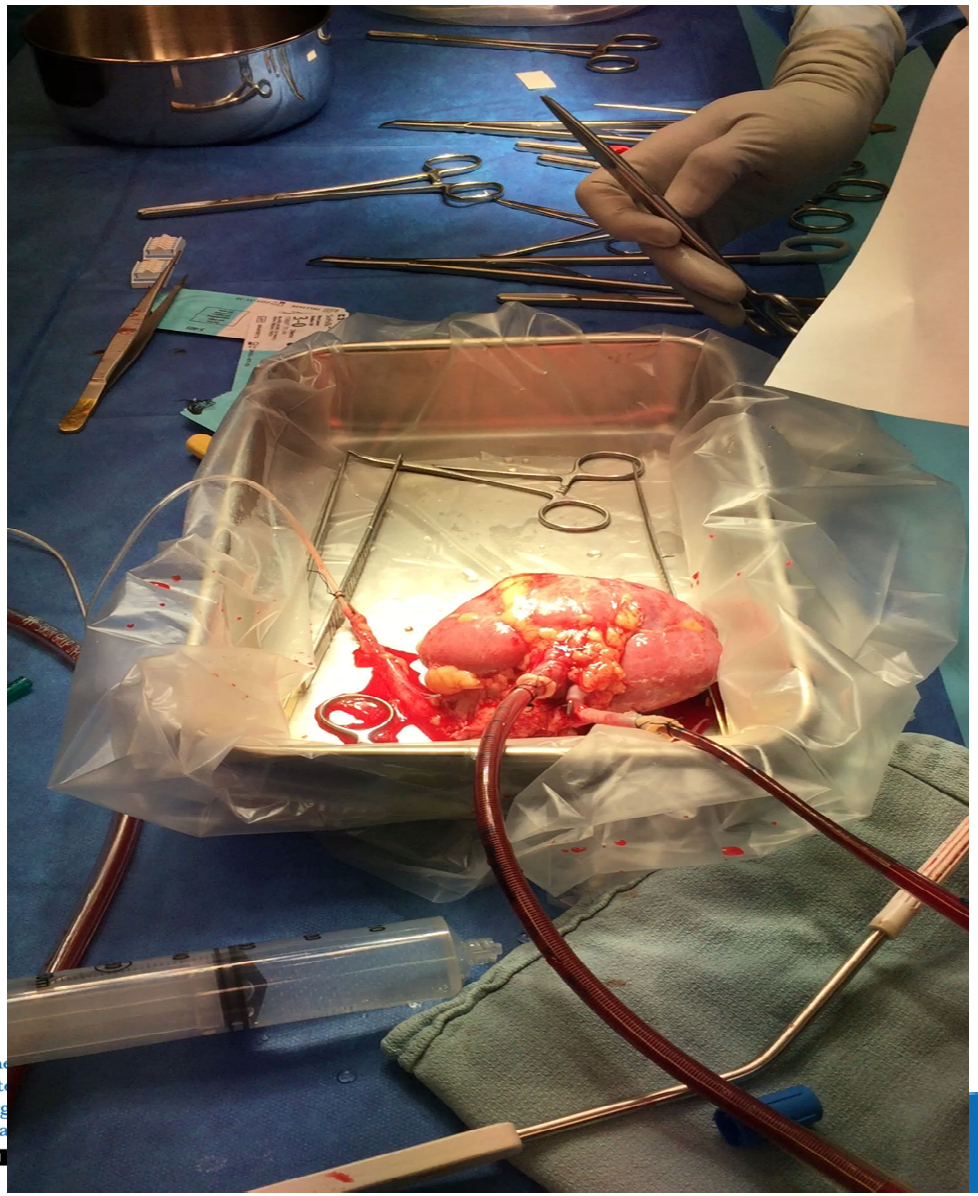
Dr. Markus Selzner, transplant surgeon at UHN, prepares the ex vivo organ perfusion system which allows a donor kidney to improve and repair itself, potentially leading to better outcomes for patients. November 2017 was the first time it has been used successfully in North America on a kidney from a deceased donor. (Photo: UHN)

A deceased donor kidney has been preserved and kept healthy outside the body in a device that mimics the body's physiological functions and successfully transplanted into a human, for the first time in North America.

The technique, unique solution, and device are part of a Phase I clinical trial at Toronto General Hospital (TG), University Health Network (UHN), assessing the safety of the device, with subsequent phases examining its efficacy.

Kidneys are the most frequently transplanted solid organ, but a continuing shortage of donor kidneys


Ex Vivo Kidney
NEVKP



First in Man Renal Transplantation After Ex Vivo Normothermic Perfusion

Sarah A. Hosgood and Michael L. Nicholson

Results:

- Left NP kidney transplanted into a 55-year-old female recipient:
  - Slow graft function but remained dialysis independent
  - Serum creatinine 3 months post KTx: 132 µmol/L
- Right SCS kidney transplanted into a 52-year-old male recipient:
  - Delayed graft function period of 26 days requiring dialysis
  - Serum creatinine 3 months post KTx: 218 µmol/L

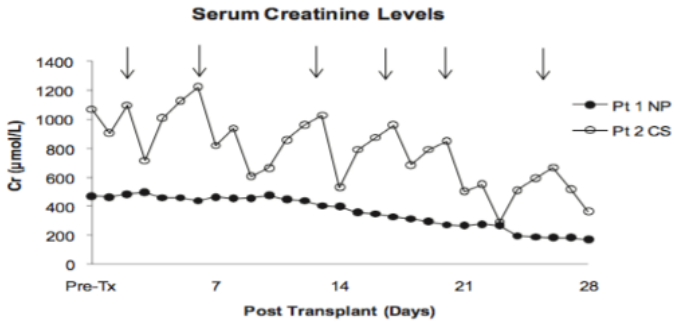


FIGURE 1. Serum creatinine levels of patient 1; normothermic perfusion (NP) and patient 2; cold storage (CS) from pretransplant (Pre-Tx) to 28 days posttransplant. The *arrows* indicate the episodes of dialysis therapy in patient 2 on days 2, 6, 13, 17, 20, and 26 posttransplant.

UHN Toronto General Hospital

American Journal of Transplantation 2013; 13: 1246–1252
Wiley Periodicals Inc.

Renal Transplantation After *Ex Vivo* Normothermic Perfusion: The First Clinical Study

M. L. Nicholson* and S. A. Hosgood

Methods:

- 18 ECD kidneys underwent static cold storage and 1 additional hour of normothermic perfusion at 34.6 ° C immediately before transplantation
- 47 ECD kidneys underwent static cold storage (control group) (matched for donor and recipient age, CIT, first transplant only)

UHN Toronto General Hospital

American Journal of Transplantation 2013; 13: 1246–1252
Wiley Periodicals Inc.

Renal Transplantation After *Ex Vivo* Normothermic Perfusion: The First Clinical Study

M. L. Nicholson* and S. A. Hosgood

Results:

- Delayed graft function (defined as need for dialysis within first 7 days)
  - 1/18 patients in NEVKP group (5.6%)
  - 17/47 patients in SCS only group (36.2%) (p = 0.014)

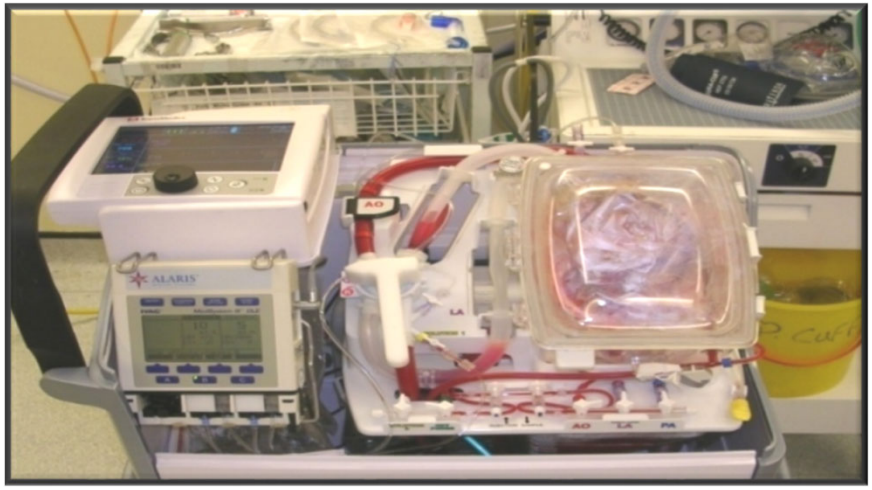
- No difference in graft (p = 0.510) or patient survival (p = 1.000)

UHN Toronto General Hospital

Chapter Four

Exvivo Heart Perfusion

TransMedics OCS (Organ Care System)



- OCS Heart
  - Monitor Cardiac Output, temperature, coronary flow, blood pressure
  - Allows direct continuous visual and ECG surveillance
  - Low percentage (2%) of primary graft failure with warm perfusion times up to 6 hours
  - Very low rate of early incidence of rejection

TransMedics OCS

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DCD Heart

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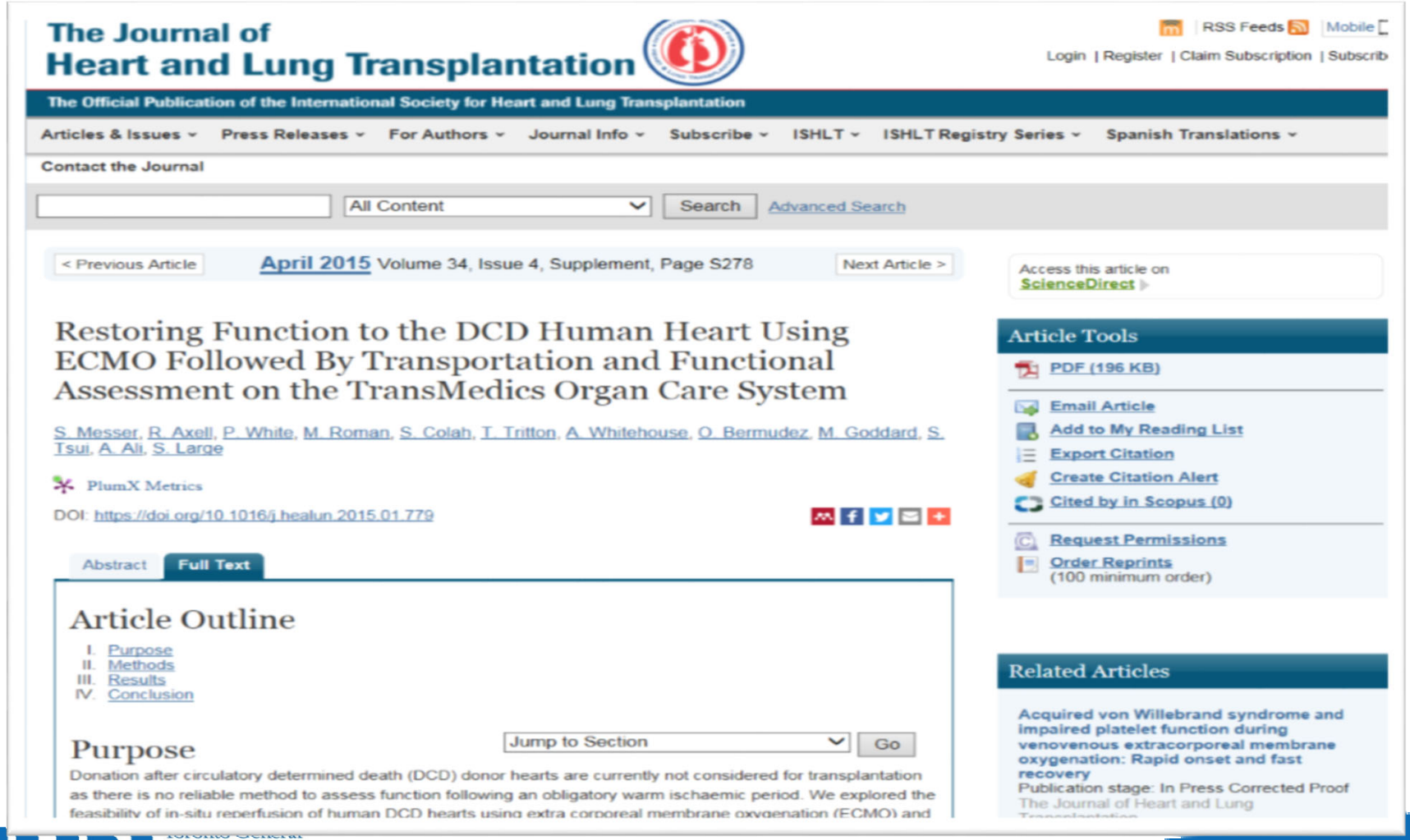
DCD Heart Protocol

- Following declaring of death, the donor transferred to OR.
- Rapid sternotomy is performed and the pericardium is opened.
- The right atrium is opened and 1.2 to 1.5L of blood is rapidly drained from the donor immediately prior to the flush of the abdominal organs.
- The donor blood is mixed together with 500cc of OCS solution that is used to prime the perfusion circuit.
- The heart is then excised and placed on the TransMedics OCS device.
- Normothermic machine perfusion is then started.
- A detachable device monitor with control capability continuously displays the ECG, aortic pressure, pump flow, coronary flow and haematocrit.
- Serial arterial and venous lactate measurements are made to optimize preservation of the organ.



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Restoring Function to the DCD Human Heart Using ECMO Followed By Transportation and Functional Assessment on the TransMedics Organ Care System

S. Messer, R. Axell, P. White, M. Roman, S. Colah, T. Tritton, A. Whitehouse, O. Bermudez, M. Goddard, S. Tsui, A. Ali, S. Large

PlumX Metrics

DOI: https://doi.org/10.1016/j.healun.2015.01.779

Abstract | Full Text

Article Outline

I. Purpose
II. Methods
III. Results
IV. Conclusion

Purpose

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Donation after circulatory determined death (DCD) donor hearts are currently not considered for transplantation as there is no reliable method to assess function following an obligatory warm ischaemic period. We explored the feasibility of in-situ reperfusion of human DCD hearts using extra corporeal membrane oxygenation (ECMO) and

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To be continued…

Thank You

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