# Uterine Transplantation: Lessons learned

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# LEARNING OBJECTIVES

At the conclusion of this presentation, participants should be able to:

- Discuss the main ethical considerations of uterus transplantation
- Discuss the process for screening potential donors and recipients
- Discuss the main advantages and disadvantages of deceased donor use versus living donor

# DISCLOSURE

- Nothing to disclose

# First live birth after Uterine transplantation published in 2/2015-Lancet

# First American baby born after a uterus transplant- November 2017

# First American baby born after a deceased donor uterus transplant- June 2019

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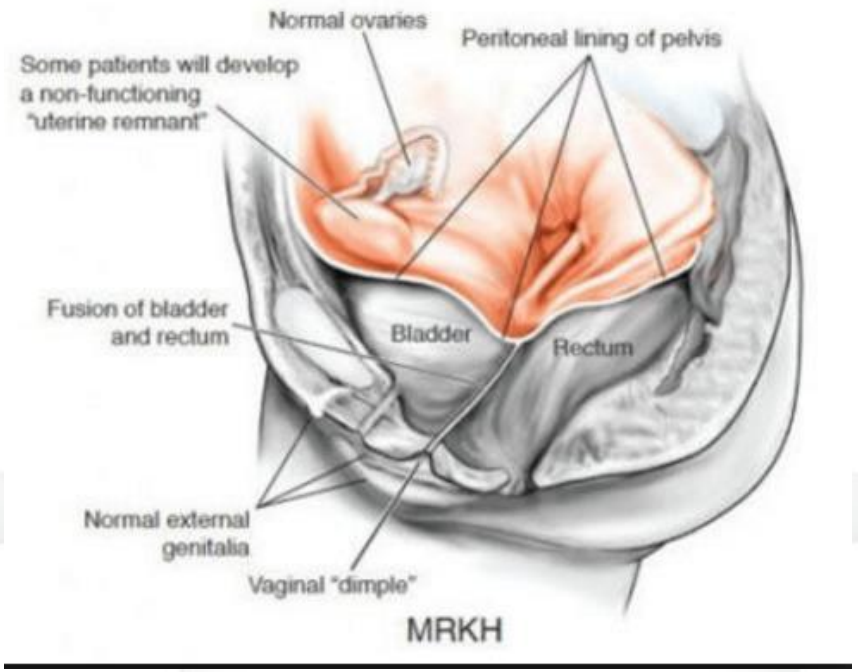
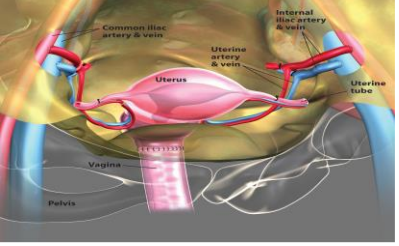
# Uterine Factor Infertility

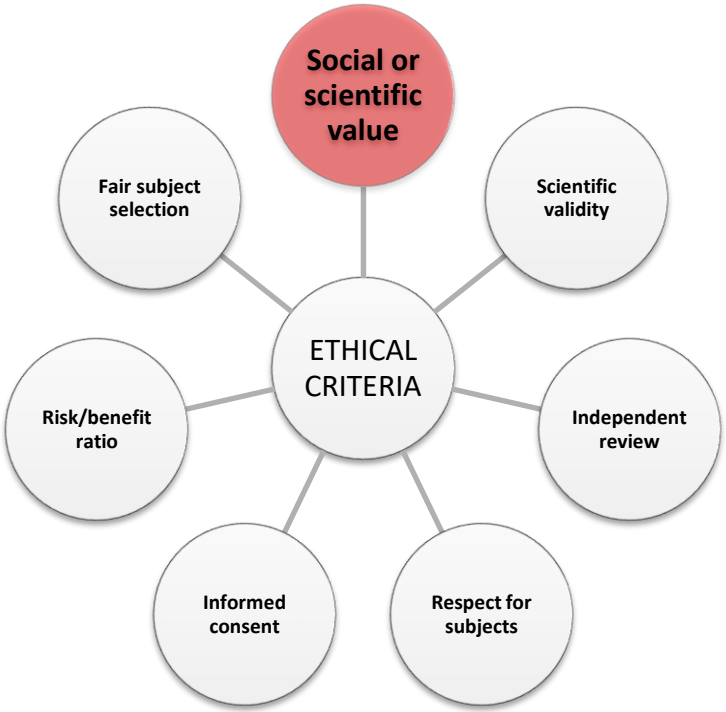
- Uterine factor infertility (UFI) affects up to 1/500 reproductive-aged women
- Prevalence of approximately 9.5 million in the US-
  Acquired UFI is the result of surgery or uterine damage
- MRKH syndrome is the predominant congenital cause of UFI
  - Prevalence of 1:4000 women




Cleveland Clinic




# Fundamental Questions: Why Do Research on Uterine Transplantation?

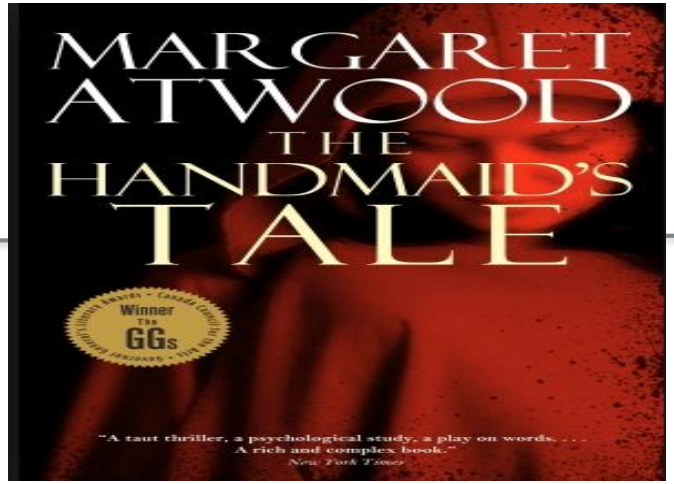


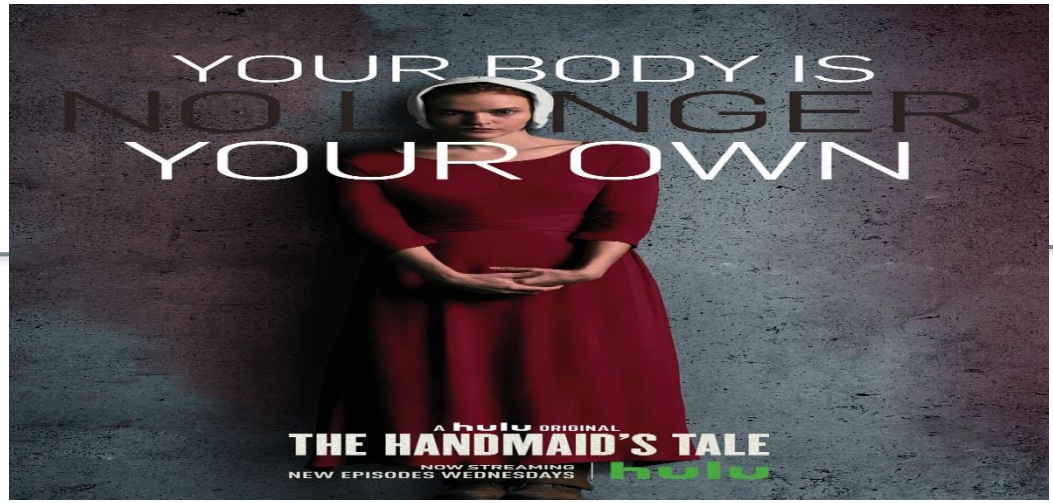

- Existing options:
  - Surrogacy
    - Legal and cultural barriers
    - Concerns about coercion and exploitation
  - Adoption
- Ethical challenges exist for each
- What does uterine transplant offer that these other options do not?

Lancet. 2015 Feb 14;385(9968):581-2. doi: 10.1016/S0140-6736(14)61792-X. Epub 2014 Oct 7.

**Uterine transplant: new medical and ethical considerations.**

Farrell RM[1], Falcone T[2].




# Consideration of the gestational carrier: a committee opinion

Ethics Committee of the American Society for Reproductive Medicine
American Society for Reproductive Medicine, Birmingham, Alabama

**KEY POINTS**

- Gestational carriers have a right to be fully informed of the risks of the surrogacy process and of pregnancy.
- Gestational carriers should receive psychological evaluation and counseling.
- Gestational carriers should have independent legal counsel.
- Reasonable economic compensation to the gestational carrier is ethical.
- The intended parents are considered to be the psychosocial parents of any children born by a gestational carrier.

# Surrogacy: yes or no?

In every case the commercial arrangement (official or not) opens up the possibility for human exploitation. We must think about surrogacy in the same way we thought about slavery or child labor. We do not have to look at the "owners" who have nothing to lose of their desire but to the most fragile person who has an elevated risk of injury in this transaction.

In IVF we never promise a couple that they will have a baby. Sometimes there is a biological limit, but sometimes there is also a moral limit that can influence the final decision.

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Department of Obstetrics and Gynecology, Hôpital Foch de Suresnes, Suresnes, France

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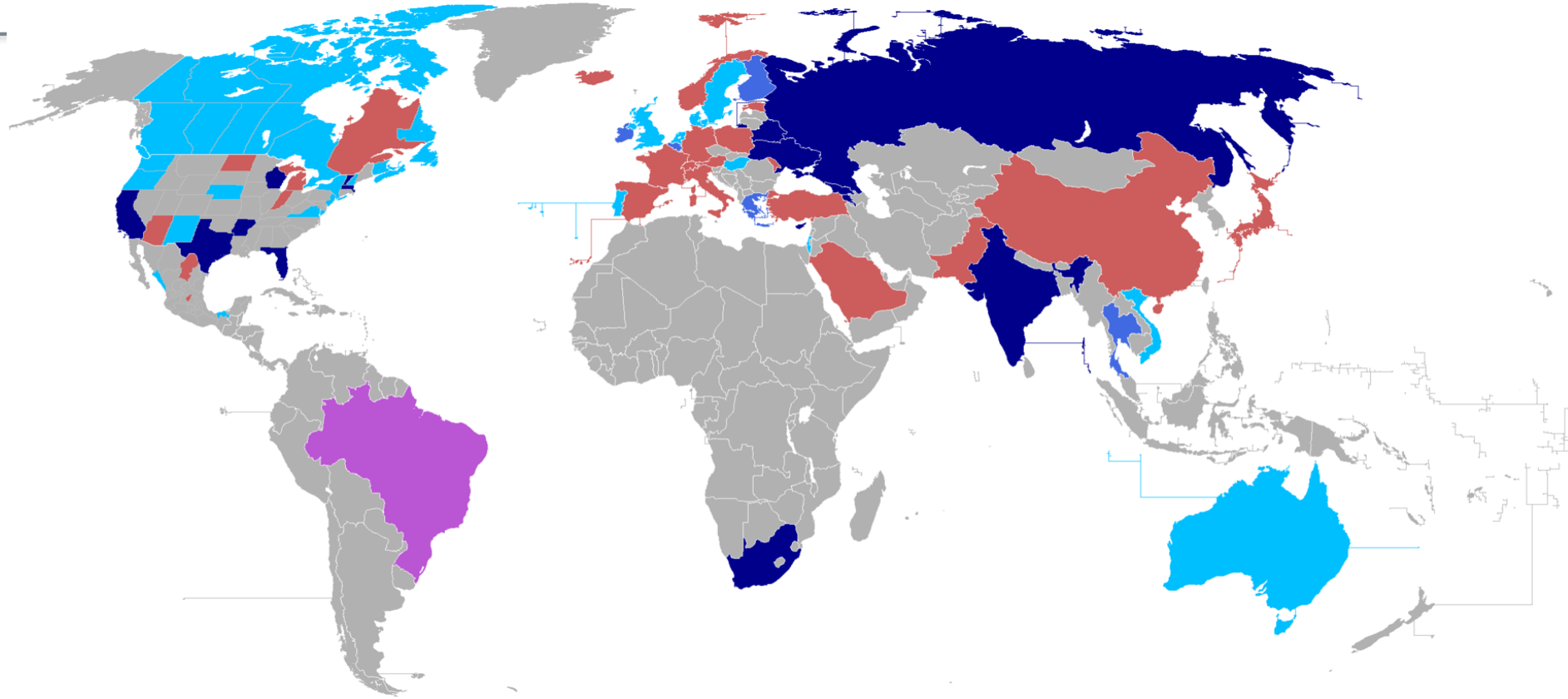


Both gainful and altruistic forms are legal | No legal regulation | Only altruistic is legal | Allowed between relatives up to second degree of consanguinity | Banned | Unregulated/uncertain situation

LA GESTACIÓN SUBROGADA EN EL MUNDO http://www.agar-asociacion.org/

# Other programs ready to go

## Uterus transplantation in France: for which patients?

S. Huet[a], A. Tardieu[a], M. Filloux[b], M. Essig[c,d], N. Pichon[e], J.F. Therme[f], P. Piver[a,d], Y. Aubard[a,d], J.M. Ayoubi[g], O. Garbin[h], P. Collinet[i], A. Agostini[j], V. Lavoue[k,l], A. Piccardo[m], T. Gauthier[a,d,*]

European Journal of Obstetrics & Gynecology and Reproductive Biology-2016

## Uterine transplantation: past, present and future

BP Jones,[a,b] S Saso,[a,b] J Yazbek,[a] JR Smith[a]

[a] West London Gynaecological Cancer Centre, Imperial College NHS Trust, London, UK [b] Department of Surgery and Cancer, Imperial College London, London, UK

*Correspondence:* BP Jones, Department of Surgery and Cancer, Imperial College London, Du Cane Road, London W12 0NN, UK. Email Benjamin.jones@nhs.net

BJOG 2016;

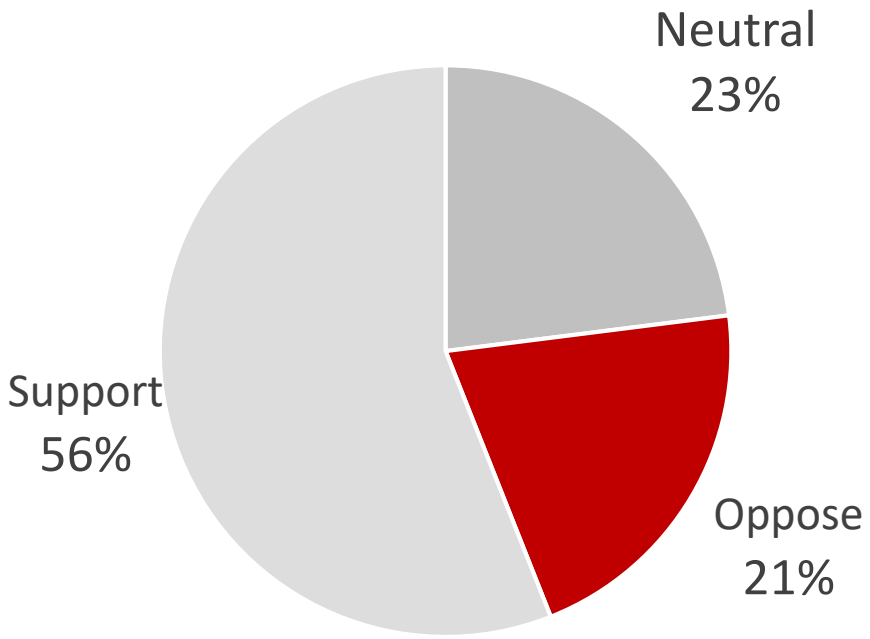
## Should uterus transplants be publicly funded?

Stephen Wilkinson, Nicola Jane Williams

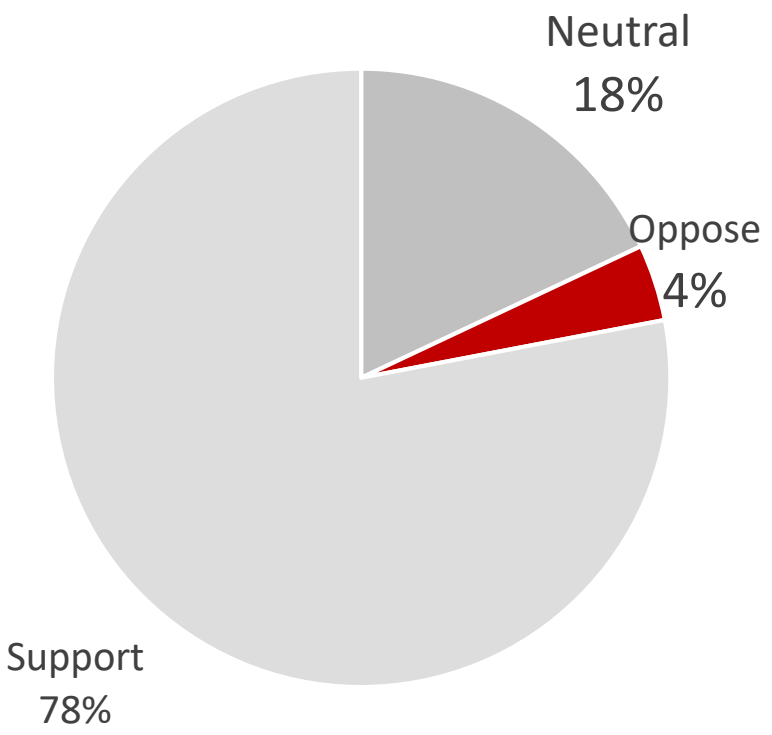
J Med Ethics 2017

# "Women should be ***allowed*** to undergo uterine transplantation"

**Physicians**




**Public**

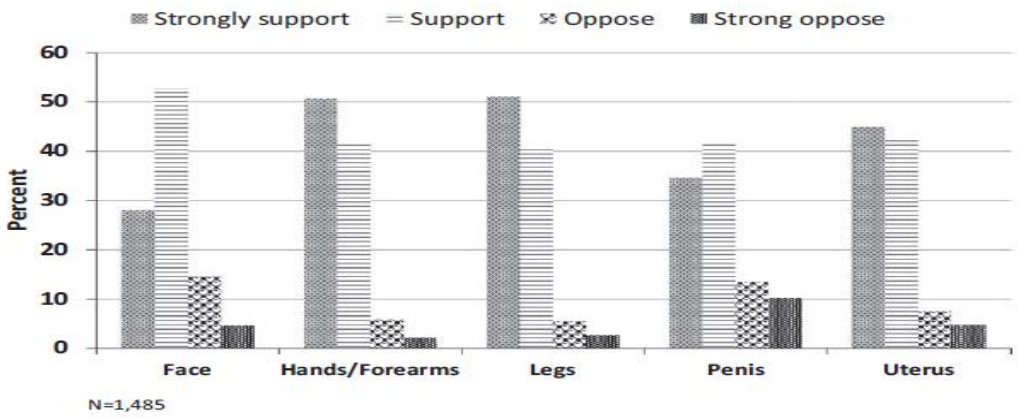


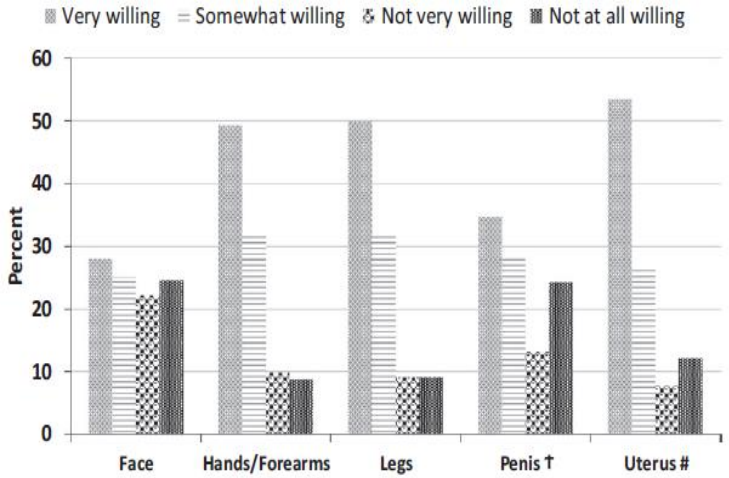
# Survey of perceptions of health care professionals in the United Kingdom toward uterine transplant

**Results**—The study had 528 participants. With respect to overall support for uterine transplant and as a possible future therapeutic option for absolute uterine factor infertility, 93.8% (n=495) thought that uterine transplant should take place if con-

## Vascularized Composite Allograft Donation and Transplantation: A Survey of Public Attitudes in the United States

*American Journal of Transplantation 2017;*



# Cleveland Clinic Team: Multidisciplinary Team

- Composition of research and medical teams
  - transplant surgeon
  - gynecologic surgeon
  - reproductive endocrinologist
  - high-risk obstetrician
  - anesthesiologist
  - Transplant psychiatrist
  - infectious disease specialist
  - social worker
  - patient advocate
  - research nurse or coordinator

# Cleveland Clinic patients

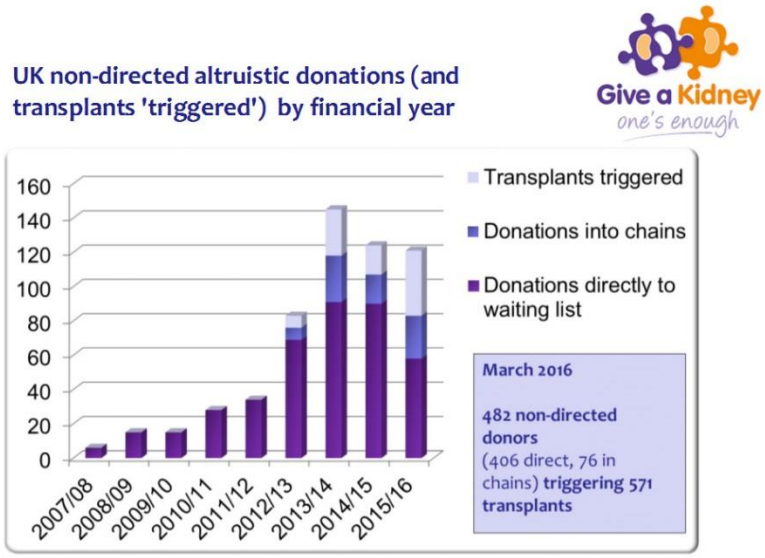
- Total of 239 candidates-screened over 7 months
- Mean age (all): 31 years old [18-52]
  - **MRKH:  28.7 years old**
  - **Acquired:  33.2 years old**

# Results

| CAUSES OF UFI | | |
|---|---|---|
| MRKH | N = 78 | 32% |
| Acquired | N = 154 | 64% |
| Intersex | N = 1 | 1% |
| Transgender | N = 5 | 2% |
| AIS | N = 1 | 1% |

# Altruistic Living Donor program

- Swedish program- mostly mothers & sisters
- Baylor program- Altruistic non-directed donors



# Living Donor- What is an ideal donor

- Good Vascular supply Exclusion- history of major medical illness that may affect vascular function (hypertension, diabetes, hyperlipidemia)
- **Kidney-pelvic kidney**
- Gynecologic history
  - cervical dysplasia and/or **human papilloma virus** (HPV)
  - endometrial hyperplasia, uterine anomalies, fibroids, polyps, or intrauterine synechiae

# Living donor: Preoperative preparation

- CT angiogram or venous phase MRI to better evaluate the pelvic vasculature pre-operatively
- five of the nine donors in Dr. Brännström's series were post-menopausal
- The use of **preoperative estrogen** may be indicated in living postmenopausal uterine donors. This, however, may place these donors at additional risk of **venous thrombotic events**, another risk that must be considered carefully during donor selection.

# Living Donor versus Deceased Donor: Is the Risk-Benefit Ratio a Simple Calculation?

## Risks for the Living Donor

- Surgery-its not just a hysterectomy
- Medications prior to surgery-risks
- Infertility
- Possible pressure or coercion
- Graft discard- donor guilt

## Risks for the Deceased Donor

- No physical risks
- The individual's autonomy; decisions about donation after death
- The donor's family

## *Risks for the Recipient*

- Use of a living donor allows for additional time for evaluation and management and convenient scheduling
- Use of deceased donor allows for more graft tissue for anastomoses
  - What you can know about that donor is limited
  - Medical situation (e.g., antibiotics, other medications prior to death), effect of ischemia times

Lancet. 2015 Feb 14;385(9968):581-2. doi: 10.1016/S0140-6736(14)61792-X. Epub 2014 Oct 7.

**Uterine transplant: new medical and ethical considerations.**

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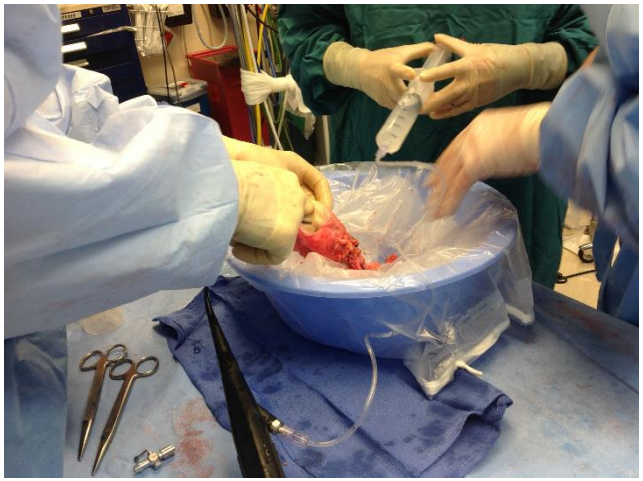
kidney
24-36 hours

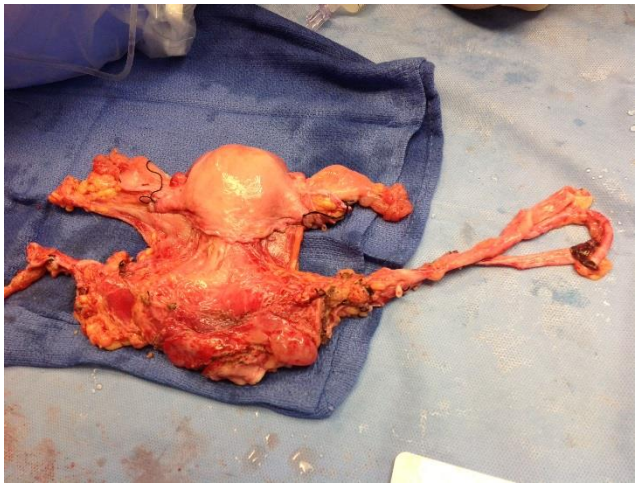
pancreas
12-18 hours

liver
8-12 hours

heart/lung
4-6 hours

- Common maximum Organ preservation times from the time of procurement and transplantation
  - Cold ischemia time
  - Warm ischemia
    - Removed from the cold transport to reperfusion
    - Can tolerate 4 hours (Hum Reprod 2017)
    - Ischemia-reperfusion injury (IRI)





**Allowable warm ischemic time and morphological and biochemical changes in uterine ischemia/ reperfusion injury in cynomolgus macaque: a basic study for uterus transplantation**

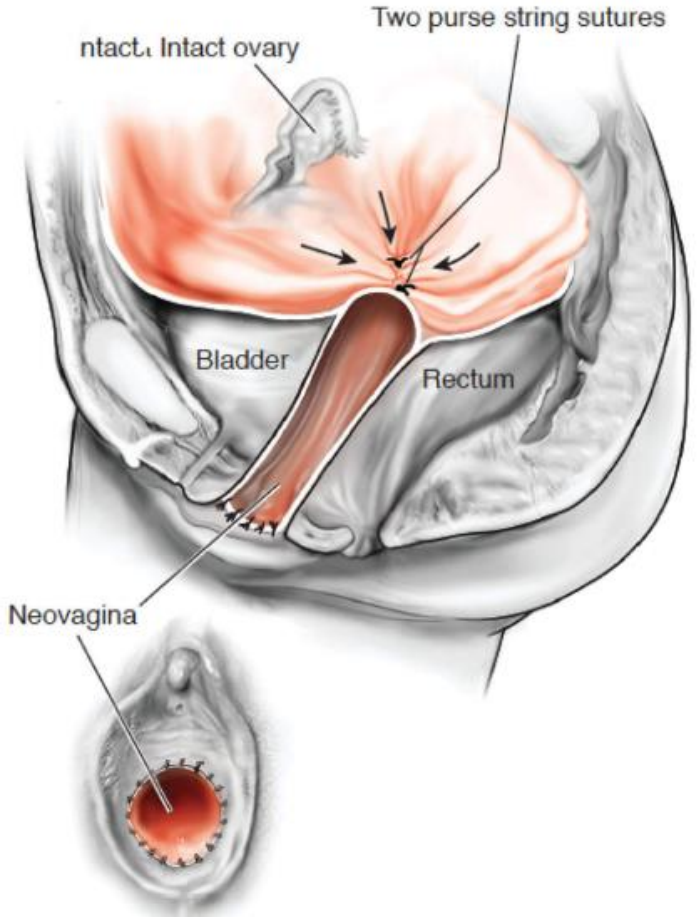
Iori Kisu[1,*], Kiyoko Umeneo[1], Masataka Adachi[1], Katsura Emoto[2],

# Psychological Evaluation-Donor & Recipient

- Extensive evaluation of the recipient
  - The uterus will be removed after two pregnancies
- Evaluation of the couple
  - Well being
  - Relationship between partners
  - Relationship with the donor-if living-related
  - Managing failure of the transplant
  - Socioeconomic situation
- Related Donor
  - “donor-guilt” if no pregnancy occurs or uterus has to be removed

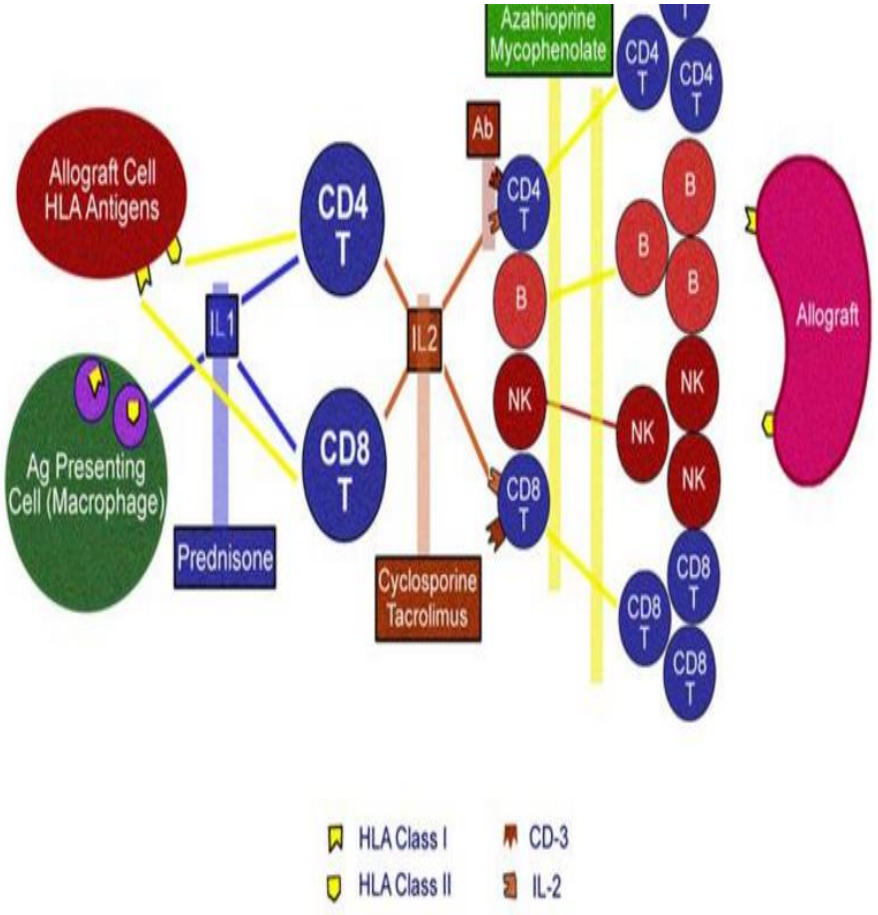
# Preparation for Transplant-Recipient

- MRKH-Short vaginal length
  - Even with patients who report regular intercourse, the vaginal length may be as short as 2-4cm
  - routine use of dilators prior to surgery should be considered in women with congenital UFI seeking transplant.
- **IVF-Number of embryos- to be frozen first**
  - **Minimum 6 blastocysts**



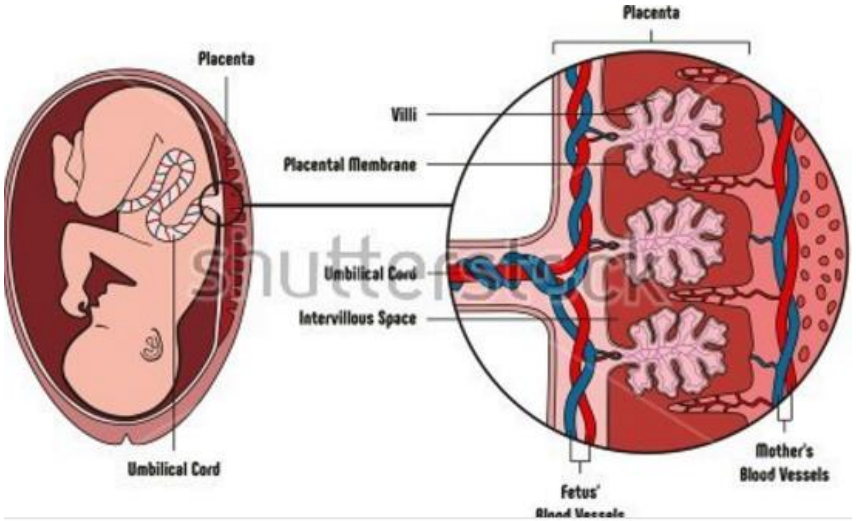
# Postoperative immune-suppression

- Immunosuppressant regimens are induced with antilymphocyte globulin and steroids.
- Maintenance immunosuppression is with tacrolimus, (goal blood level of 7-10ng/ml), mycophenolate mofetil (MMF), and steroids.



# Immunosuppressive agents-Pregnancy

- FET after 1 year
- MMF-stopped prior to any pregnancy attempt -replaced with azathioprine.
- Tacrolimus, steroids and azathioprine have not demonstrated teratogenicity
- Immunosuppressive medication used for uterine transplantation protocols do cross the placenta, however, the regimens used are similar to those used in other solid organ transplants and appear to be the safest choices .

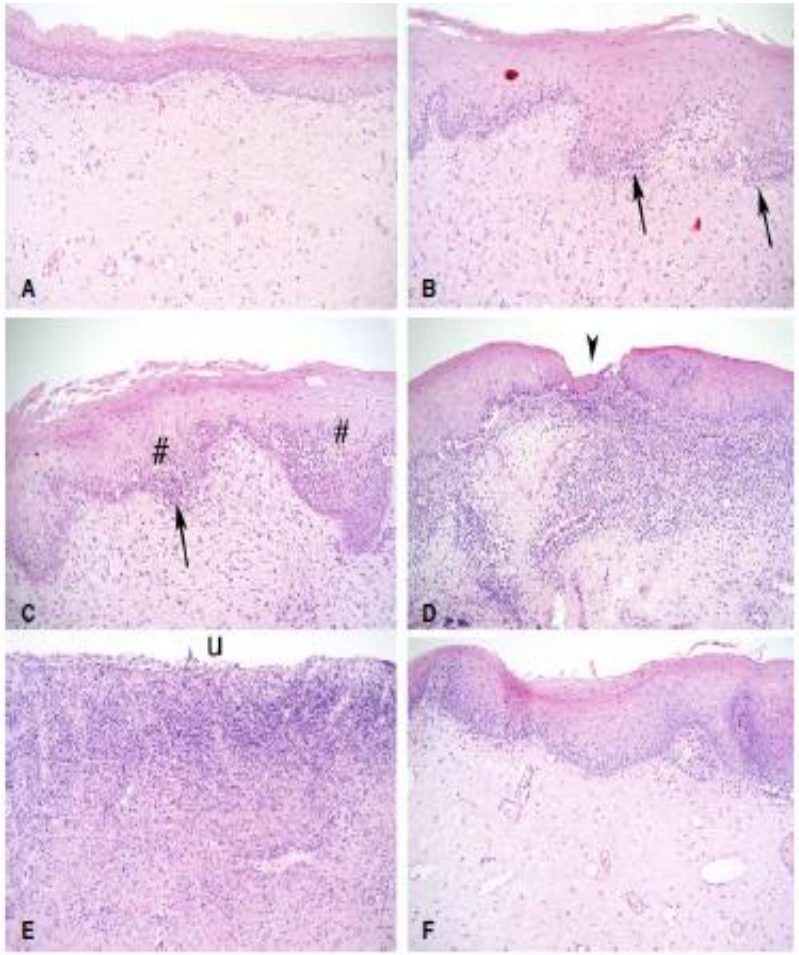


# How to monitor Rejection

**Monitoring of Human Uterus Transplantation With Cervical Biopsies: A Provisional Scoring System for Rejection**

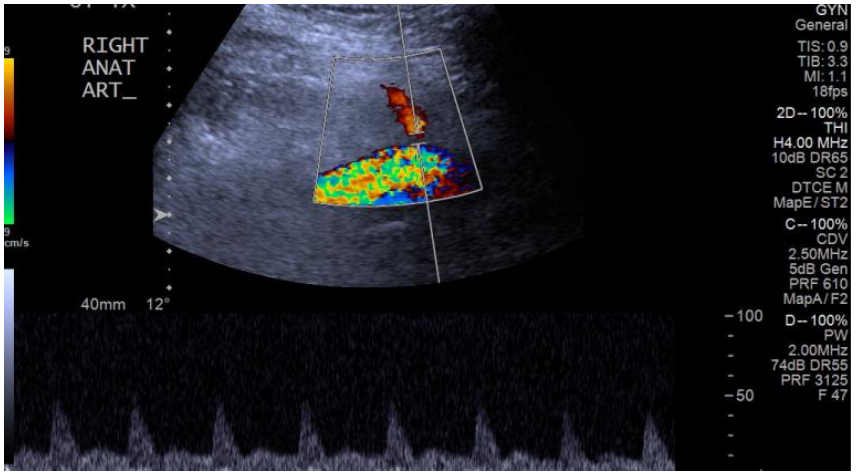
American Journal of Transplantation 2017; 17: 1628–1636

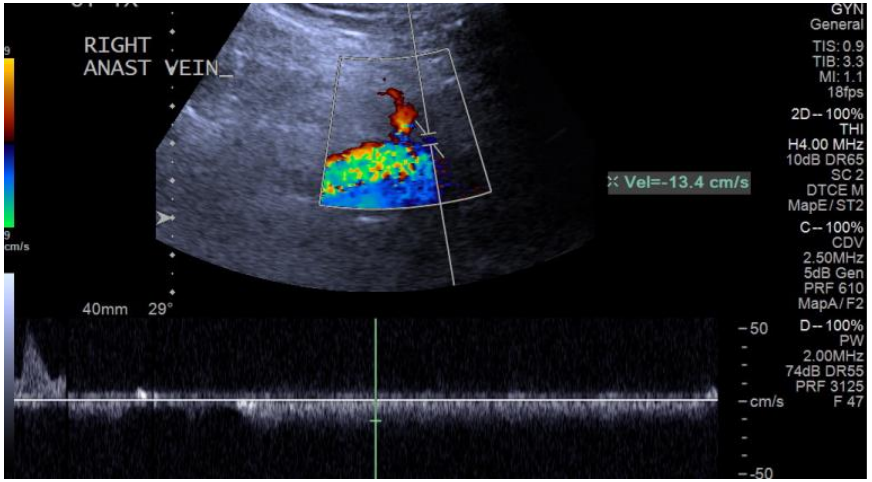
- **Cervical punch biopsies**-also used in pregnancy
- 1,2,4 weeks; monthly for 1 year then 1-3 months
- Swedish experience
  - 8% biopsies showed rejection
  - Mild-moderate rejection treated with steroids
  - No grafts lost to rejection



# How to monitor Perfusion

- **Regular ultrasound** monitoring of the graft, specifically the uterine artery blood flow, using color Doppler is recommended.



# Swedish experience: Average donor age of 53 ± 7 years.

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## TABLE 3

**Surgical, anesthesiologic, and hospitalization parameters.**

| Pair | Age (y) | Donors' relation to recipients | HLA mismatch | Cytomegalovirus Ig | Epstein-Barr virus Ig | Duration: Anesthesia | Duration: Surgery | Duration: Back-table Preparation | Duration: Anastomoses Veins | Duration: Anastomoses Arteries | Duration: Ischemia Warm | Duration: Ischemia Cold | Arterial blood flow (mL/min)[a] | Blood loss (L) | Intraop. autoblood (L) | Blood transfusion (L)[b] | High grad complic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipient 1 | 33 | Mother | 2/0 | pos | pos | 15 h 0 min | 4 h 10 min | 1 h 30 min | 39 min | 35 min | 1 h 18 min | 1 h 30 min | 63 | 0.4 | 0 | 0 | Grad |
| Donor 1 | 52 | | | neg | pos | 12 h 4 min | 10 h 54 min | | | | | | | 0.3 | 0 | 0 | |
| Recipient 2 | 38 | Mother | 2/1 | neg | neg | 13 h 57 min | 4 h 17 min | 1 h 47 min | 43 min | 29 min | 1 h 38 min | 1 h 47 min | 50 | 1.6 | 0.49 | 0 | Grad |
| Donor 2 | 58 | | | pos | pos | 13 h 46 min | 12 h 37 min | | | | | | | 2.4 | 0.49 | 0 | Grad |
| Recipient 3 | 28 | Mother's sister | 3/1 | pos | pos | 10 h 50 min | 4 h 50 min | 1 h 4 min | 31 min | 25 min | 1 h 34 min | 1 h 4 min | 50 | 0.8 | 0.2 | 0 | |
| Donor 3 | 54 | | | neg | pos | 13 h 37 min | 12 h 53 min | | | | | | | 0.8 | 0 | 0 | |
| Recipient 4 | 27 | Mother | 2/1 | neg | pos | 6 h 5 min | 5 h 4 min | 0 h 57 min | 32 min | 30 min | 1 h 17 min | 0 h 57 min | 43 | 0.25 | 0 | 0 | |
| Donor 4 | 50 | | | neg | neg | 11 h 11 min | 10 h 34 min | | | | | | | 0.6 | 0 | 0 | |
| Recipient 5 | 35 | Family friend | 3/2 | pos | pos | 5 h 45 min | 4 h 55 min | 1 h 6 min | 32 min | 30 min | 1 h 13 min | 1 h 6 min | 40 | 0.75 | 0 | 1.2 | Grad |
| Donor 5 | 61 | | | pos | pos | 11 h 6 min | 10 h 17 min | | | | | | | 0.6 | 0 | 0 | |
| Recipient 6 | 27 | Mother | 1/1 | neg | pos | 8 h 17 min | 4 h 30 min | 2 h 0 min | 60 min | 23 min | 1 h 24 min | 2 h 0 min | 75 | 0.7 | 0.18 | 0 | |
| Donor 6 | 53 | | | pos | pos | 11 h 50 min | 10 h 52 min | | | | | | | 0.7 | 0.11 | 0 | |
| Recipient 7 | 28 | Mother | 1/0 | pos | pos | 6 h 35 min | 4 h 44 min | 0 h 54 min | 20 min | 30 min | 1 h 15 min | 0 h 54 min | 30 | 0.3 | 0 | 0 | Grad |
| Donor 7 | 50 | | | pos | pos | 11 h 35 min | 10 h 17 min | | | | | | | 0.4 | 0 | 0 | |
| Recipient 8 | 33 | Sister | 1/1 | pos | pos | 7 h 53 min | 5 h 56 min | 0 h 56 min | 25 min | 24 min | 1 h 14 min | 0 h 56 min | 30 | 0.75 | 0.2 | 0 | Grad |
| Donor 8 | 37 | | | pos | pos | 11 h 55 min | 11 h 23 min | | | | | | | 0.4 | 0 | 0 | |
| Recipient 9 | 35 | Mother-in-law | 3/2 | neg | neg | 8 h 14 min | 4 h 31 min | 1 h 28 min | 42 min | 47 min | 1 h 32 min | 1 h 28 min | 10 | 0.5 | 0 | 0 | Grad |
| Donor 9 | 62 | | | pos | pos | 14 h 5 min | 13 h 8 min | | | | | | | 2.1 | 0.52 | 0 | |
| All recipients | 31.5 ± 3.9 | | | | | 9 h 4 min ± 3 h 14 min | 4 h 46 min ± 30 min | 1 h 18 min ± 23 min | 36 ± 11 min | 30 ± 6.9 min | 1 h 23 min ± 9 min | 1 h 18 min ± 23 min | 44 ± 18 | 0.67 ± 0.38 | 0.12 ± 0.15 | 0.13 ± 0.36 | |
| All donors | 53.0 ± 7 | | | | | 12 h 13 min ± 60 min | 11 h 37 min ± 1 h 5 min | | | | | | | 0.92 ± 0.73 | 0.12 ± 0.21 | 0 ± 0 | |

*Note:* Plus-minus values are mean ± SD.

[a] Peak value of the dominant artery.

[b] Packed red cells.

[c] According to the Clavien-Dindo classification of surgical complications (17).

*Brännström. Uterus transplantation trial. Fertil Steril 2014.*

# Pregnancy Rate: mean age of the donors-53 years (37-62)

**Recipient age-Donor age**

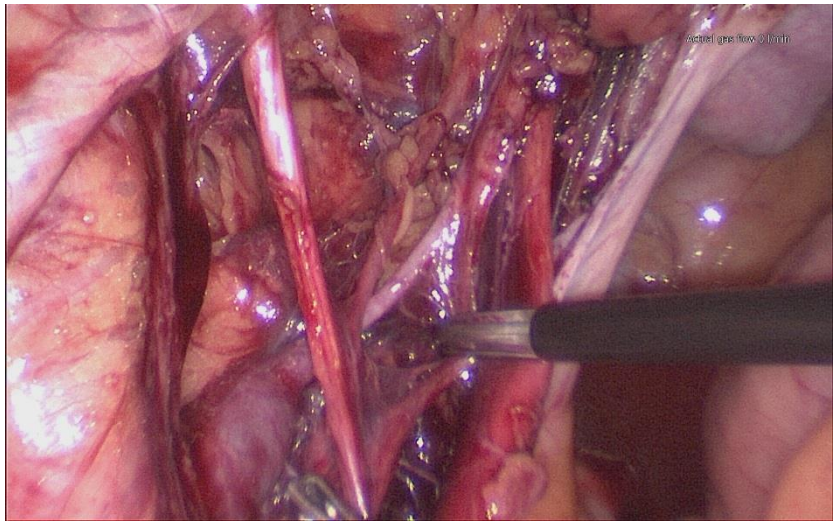
- 33---52
- 38---58
- 28---54
- 27---50
- 35---61
- 27---53
- 28---50
- 33---37
- 35---62

**No of ET-No of preg-No births**

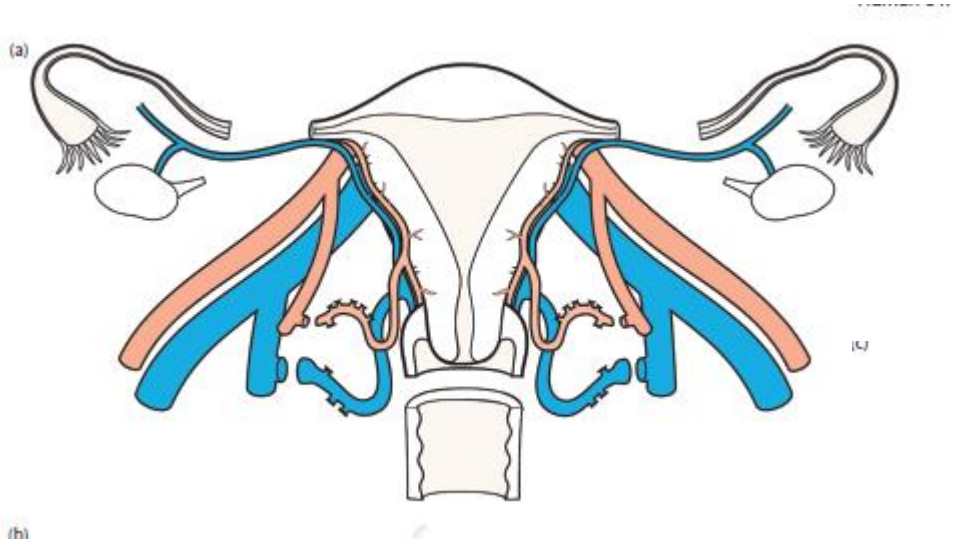
- 9---2 pregnancies---2births
- Uterus removed
- 14---6 pregnancies-5 Ab
- 9---2 pregnancies-2 births
- 1---1 pregnancy -1 birth
- 2---1 pregnancy-1 birth
- 1---1 pregnancy- 1 birth
- 6---1 pregnancy-1 birth
- Uterus removed

Age range of recipients 27-38

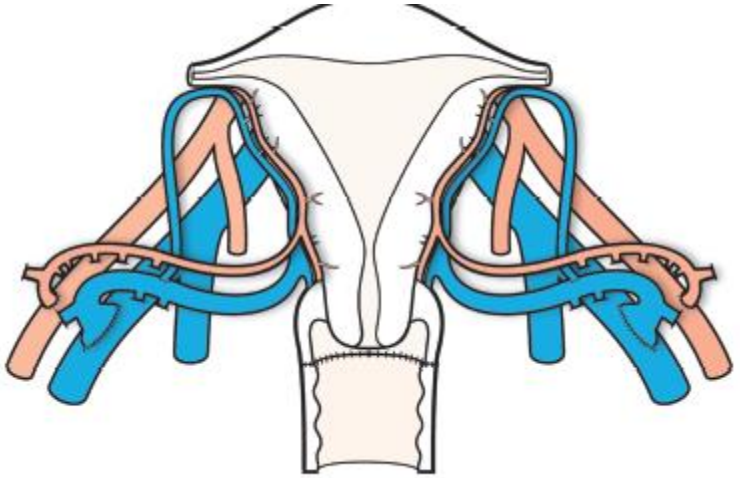
Age range of donors 37-62



# Technical challenges-Living Donor




MATS BRÄNNSTRÖM



# Living Donor Uterus Transplantation: A Single Center's Observations and Lessons Learned From Early Setbacks to Technical Success

[1]Annette C. and Harold C. Simmons Transplant Institute, Baylor University Medical Center, Dallas, TX

**Table 4:** Donor characteristics

| Donors | 01-D | 02-D | 03-D | 04-D | 05-D |
|---|---|---|---|---|---|
| Age | 42 | 55 | 45 | 34 | 36 |
| BMI | 26 | 23 | 21 | 23 | 18 |
| Smoking history | None | None | None | None | None |
| Pregnancies | 2 | 3 | 5 | 2 | 4 |
| Live births | 2 | 3 | 3 | 2 | 4 |
| Deliveries | 2 SVD | 3 SVD | 3 SVD | 2 SVD | 4 SVD |
| Menopausal state | No | yes, since 1 year | No | No | No |
| History of cancer | None | None | Family history of ovarian cancer | None | None |
| Uterine abnormalities | None | 3 Fibroids[1] | None | None | None |
| Diabetes history | None | None | None | None | None |

**Table 5:** Donor perioperative course

| Donors | 01-D | 02-D | 03-D | 04-D | 05-D |
|---|---|---|---|---|---|
| Surgical time | 480 min | 540 min | 480 min | 480 min | 480 min |
| ICU days | 0 | 0 | 0 | 0 | 0 |
| Inpatient stay | 6 | 6 | 6 | 5 | 7 |
| Complications | Leg/buttocks pain | None | Depression, vaginal cuff dehiscence | UTI | Fecal impaction |

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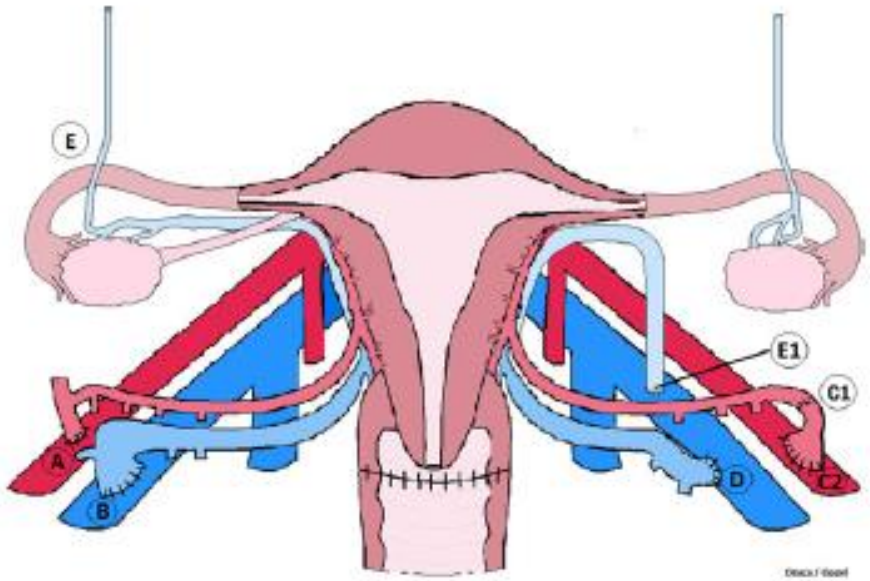
[1]Annette C. and Harold C. Simmons Transplant Institute, Baylor University Medical Center, Dallas, TX




- "**Three were removed** for graft necrosis secondary to outflow problems
- **The venous outflow was responsible** for the failure of the grafts"
- the first three recipients had venous outflow with a combination of the uterine veins and the utero-ovarian veins, whereas for last 2 recipients , **the venous outflow was via the utero-ovarian veins.**Delivered a live birth**

## Human uterine transplantation: a review of outcomes from the first 45 cases

BP Jones,[a,b,c] S Saso,[a,b] T Bracewell-Milnes,[b,c] M-Y Thum,[b,c] J Nicopoullos,[b,c] C Diaz-Garcia,[d,e] P Friend,[f,g] S Ghaem-Maghami,[a,b] G Testa,[h] L Johannesson,[h] I Quiroga,[f] J Yazbek,[a,b] JR Smith[a,b]

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**Clavien-Dindo IIIb in Living Donor :**

- *Ureteric injuries: 5.6% (n=2)*
- *Ureto-vaginal fistula:2.7% (n=1)*
- *Vaginal cuff dehiscence: 2.7% (n=1)*

| | **Living Donor (N=36)** | **Brain-dead donor (N=9)** |
|---|---|---|
| **Age (mean±SD)** | 45.4±8.6 | 38.3±14.3 |
| **CIT (mean±SD)** | 2h±1h | 5h±2h |
| **Surgical complications** | Clavien-Dindo IIIb:11.1% Clavien-Dindo I-II: 27.8% | NA |

# Living Donor UTx and Psychological Risk

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Advance Access Publication on June 26, 2019 doi:10.1093/humrep/dez087

human reproduction ORIGINAL ARTICLE *Psychology and counselling*

## Donors' health-related quality-of-life and psychosocial outcomes 3 years after uterus donation for transplantation

**Stina Järvholm[1,*], Niclas Kvarnström, Pernilla Dahm-Kähler, and Mats Brännström[1,3]**

[1]Department of Obstetrics and Gynecology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden [2]Department of Transplantation, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden [3]Stockholm IVF, ELIGIN, Stockholm, Sweden

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*Submitted on January 4, 2019; resubmitted on April 24, 2019; editorial decision on May 7, 2019*

## Conclusion

**There appear to be some donors at risk of for increased mental health-related quality-of-life, the common factor being that they had not experienced success for the recipient after transplantation**

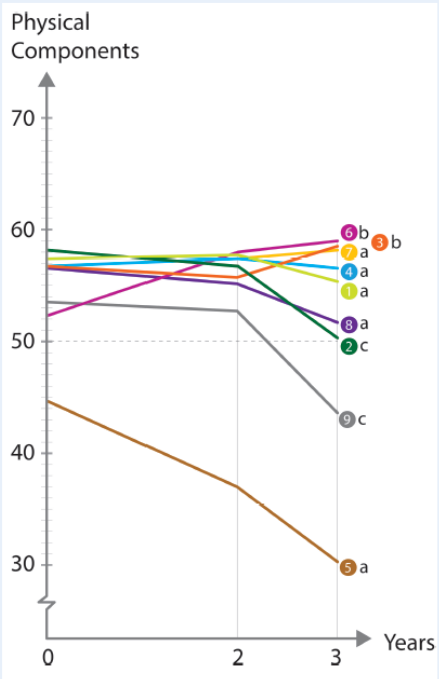



**Figure 1 Individual donor-summarised scores of physical components (PCS) of SF-36 at baseline prior to transplantation and at 2 and 3 years after transplantation.** Outcomes for recipients: a) birth; b) continued pregnancy attempts; c) graft removal before pregnancy attempt.

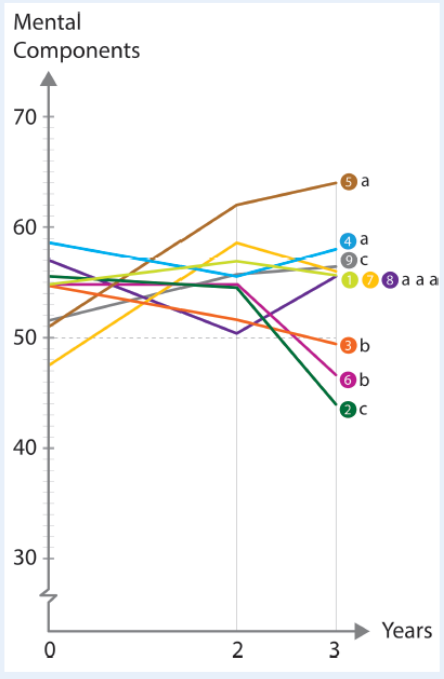



**Figure 2 Individual donor-summarised scores of mental components (MCS) of SF-36 at baseline prior to transplantation and at 2 and 3 years after transplantation.** Outcomes for recipients: a) birth; b) continued pregnancy attempts; c) graft removal before pregnancy attempt.

# Summary of Living Donor-Risks

- Lengthy surgery- The average time for recovery of the uterus in a living donor using an exploratory laparotomy and a highly skilled surgical team consisting of both gynecologic and transplant surgeons in Dr. Brännström's work was 10-13 hours
- The use of HRT in women that are postmenopausal & at risk for a vascular event
- Graft fails, not usable or recipient does not achieve pregnancy- donor guilt

# Cleveland Clinic Experience

## Deceased donor uterine transplantation

Rebecca Flyckt, M.D.,[a] Alexander Kotlyar, M.D.,[a] Sara Arian, M.D.,[a] Bijan Eghtesad, M.D.,[b] Tommaso Falcone. M.D..[a] and Andreas Tzakis. M.D.[b]

Fertility and Sterility
Vol. 107, Iss. 3, March 2017

Current Commentary

## Deceased Donor Uterine Transplantation

### Innovation and Adaptation

*Rebecca L. Flyckt, MD, Ruth M. Farrell, MD, MA, Uma C. Perni, MD, MPH, Andreas G. Tzakis, MD, PhD, and Tommaso Falcone, MD*

Obstetrics & Gynecology.
128(4):837-42, 2016 Oct.

# Recipient Risk

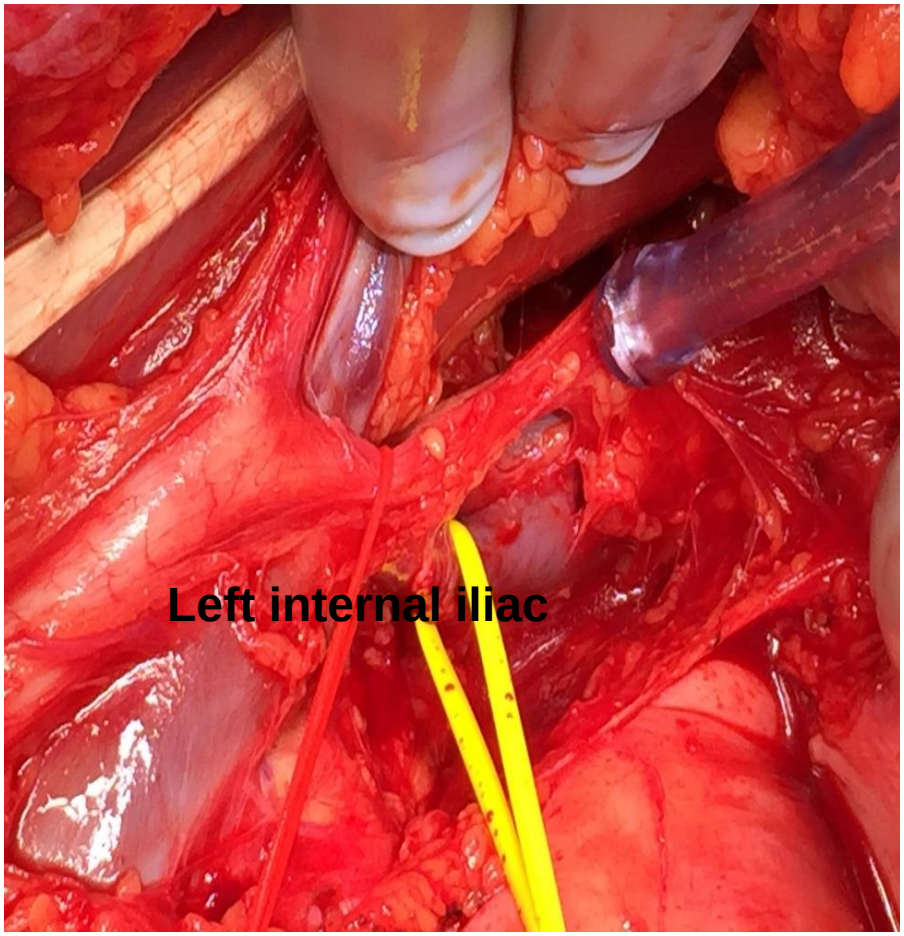
[1]Annette C. and Harold C. Simmons Transplant Institute, Baylor University Medical Center, Dallas, TX

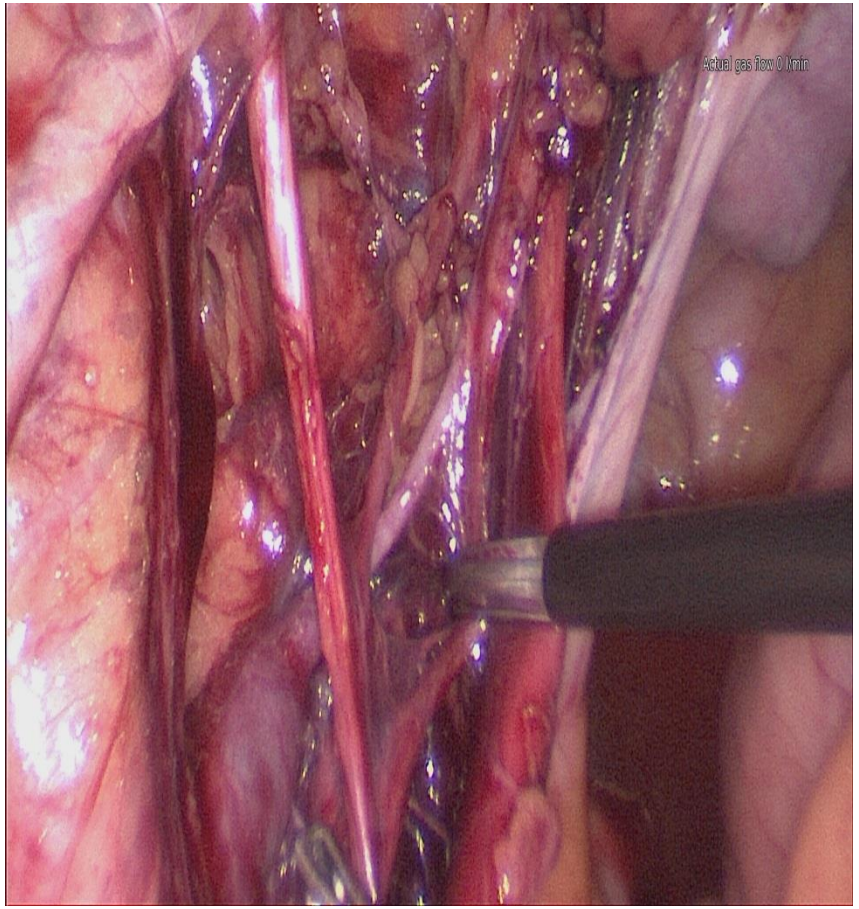
**Table 6:** Recipient perioperative course

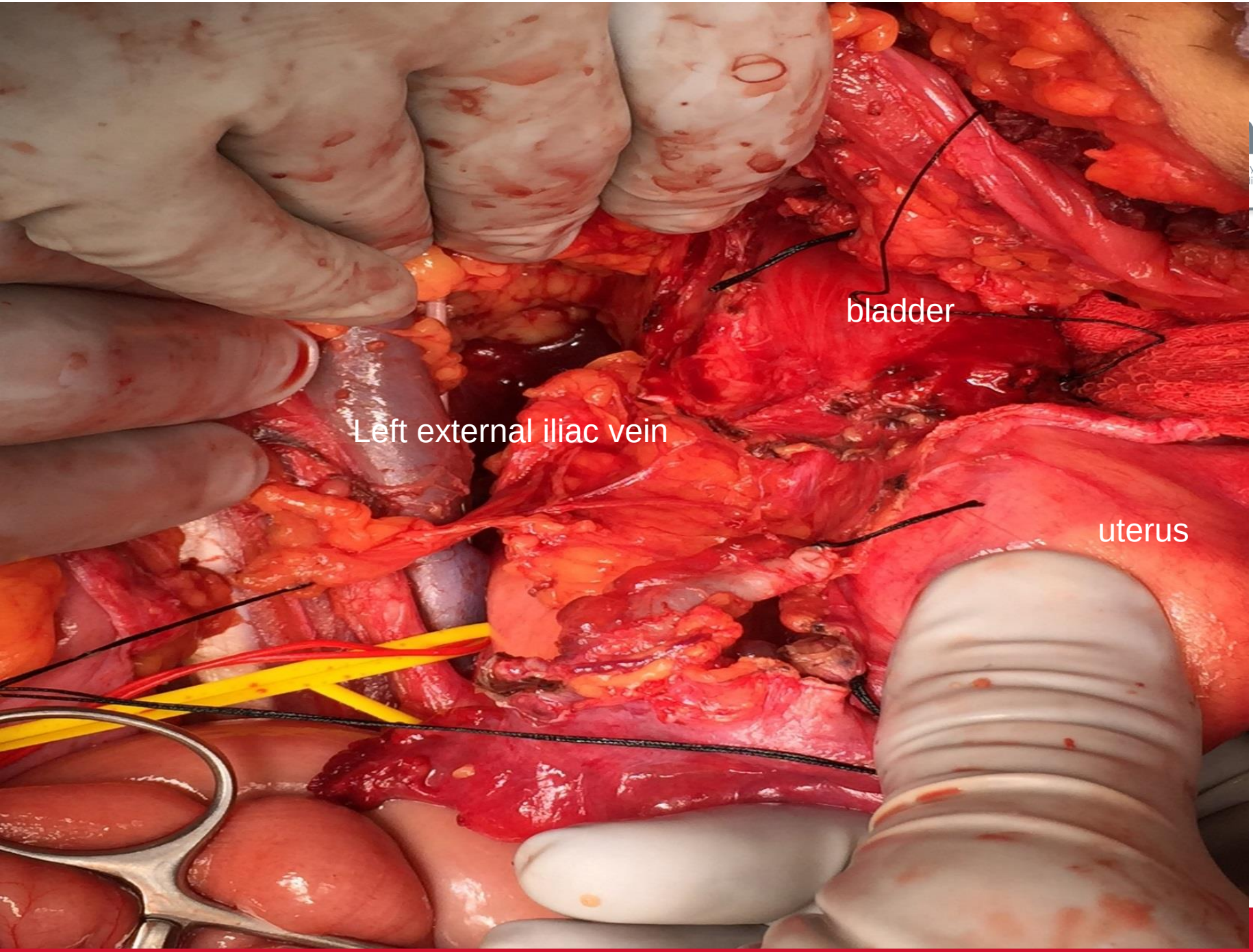
| Recipients | 01-R | 02-R | 03-R | 04-R | 05-R |
|---|---|---|---|---|---|
| Surgical time | 360 min | 360 min | 330 min | 270 min | 270 min |
| EBL (mL) | 2000 | 500 | 500 | 500 | 300 |
| ICU (days) | 2 | 3 | 2 | 2 | 1 |
| Inpatient stay | 7 | 8 | 15 | 10 | 7 |
| Complications | Hemoperitoneum and artery thrombosis (POD 0), graft hysterectomy POD 14 | Graft hysterectomy POD 12 | Uterine artery thrombosis (POD 0), graft hysterectomy POD 6 | None | None |
| Pathology | Necrosis, hemorrhagic stroma, congestion | Ischemic necrosis | Necrosis, hemorrhagic stroma, congestion | | |
| CIT | 180 min | 270 min | 180 min | 180 min | 240 min |
| WIT | 74 min | 68 min | 60 min | 67 min | 40 min |

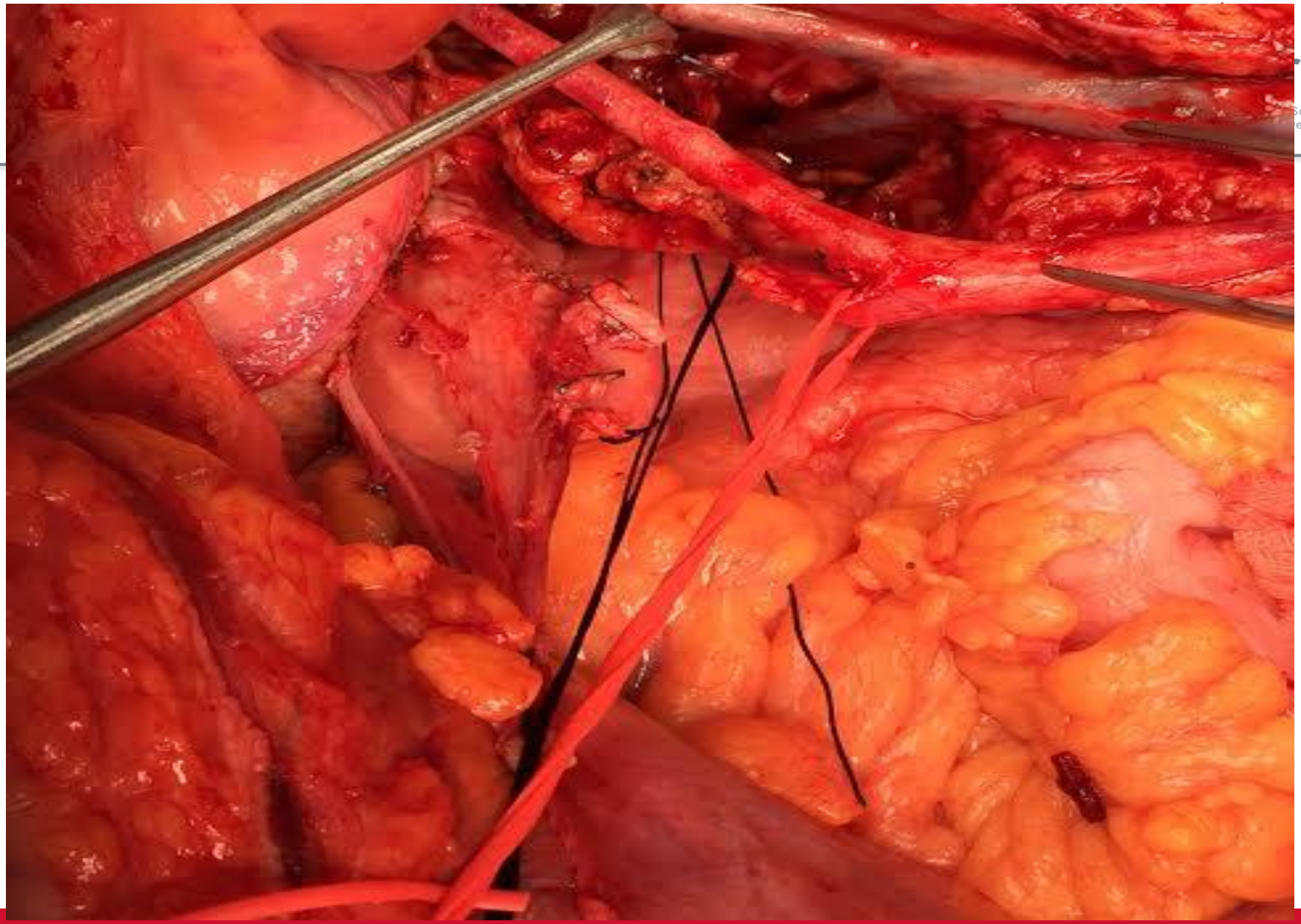
CIT, cold ischemia time; EBL, estimated blood loss; ICU, intensive care unit; POD, postoperative day; WIT, warm ischemia time.

# Deceased (Left) & Living (right) Donor internal iliac vessels

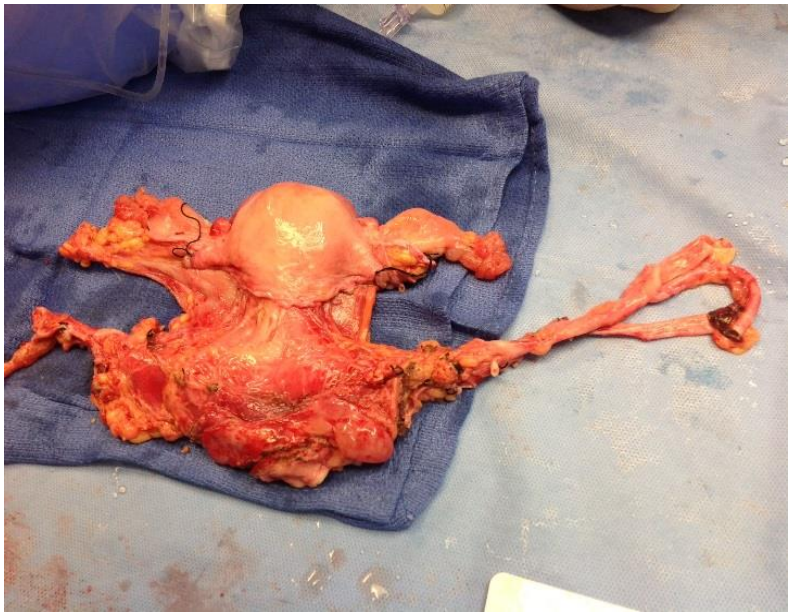



bladder
Left external iliac vein
uterus



# Vessels: Live vs. Deceased Donor



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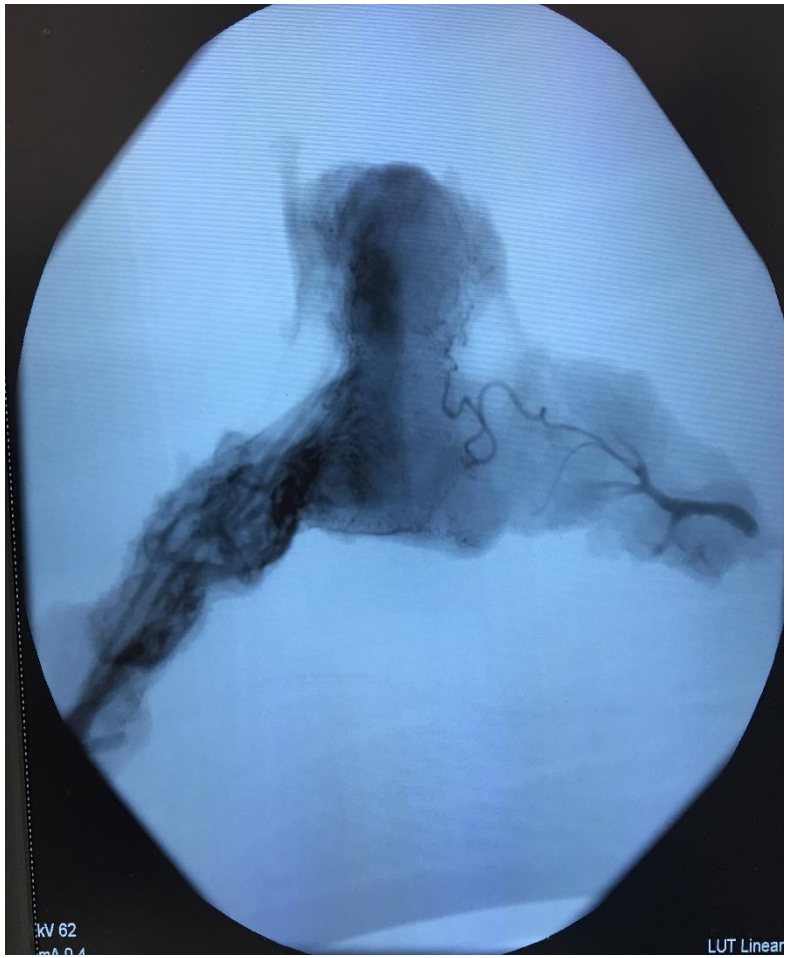
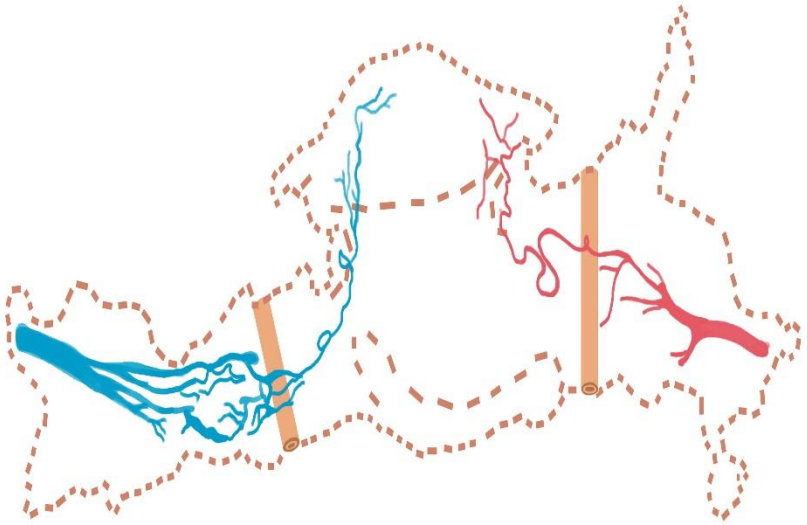
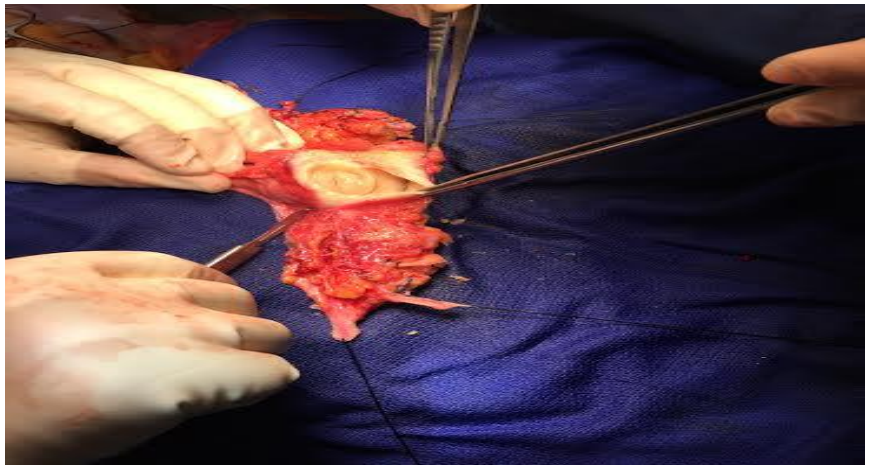
Flyckt R, Kotlyar A, Arian S, Eghtesad B, **Falcone T**, Tzakis A. Deceased donor uterine transplantation.Fertil Steril. 2017

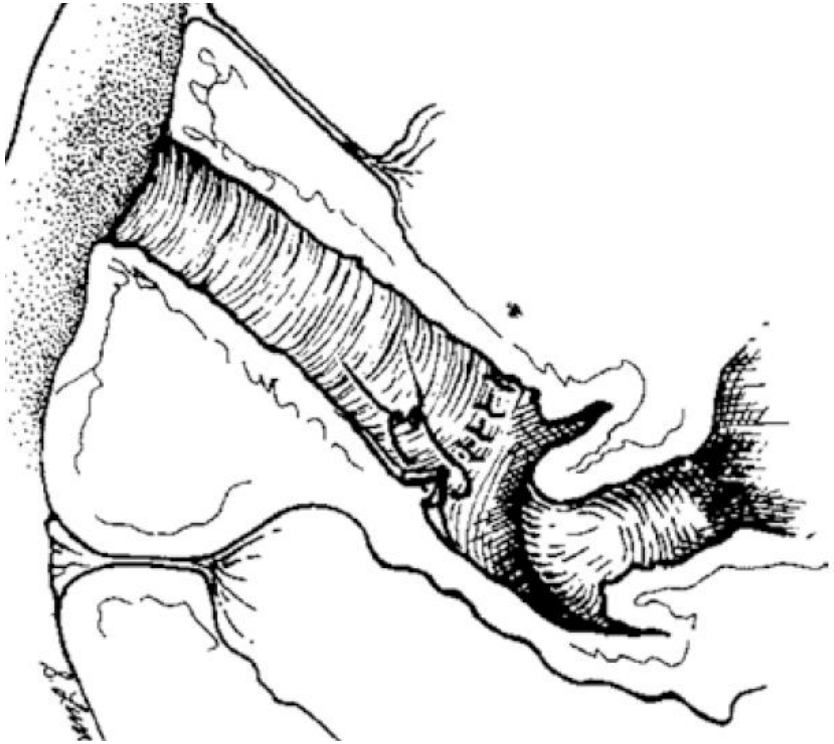

kV 62
LUT Linear

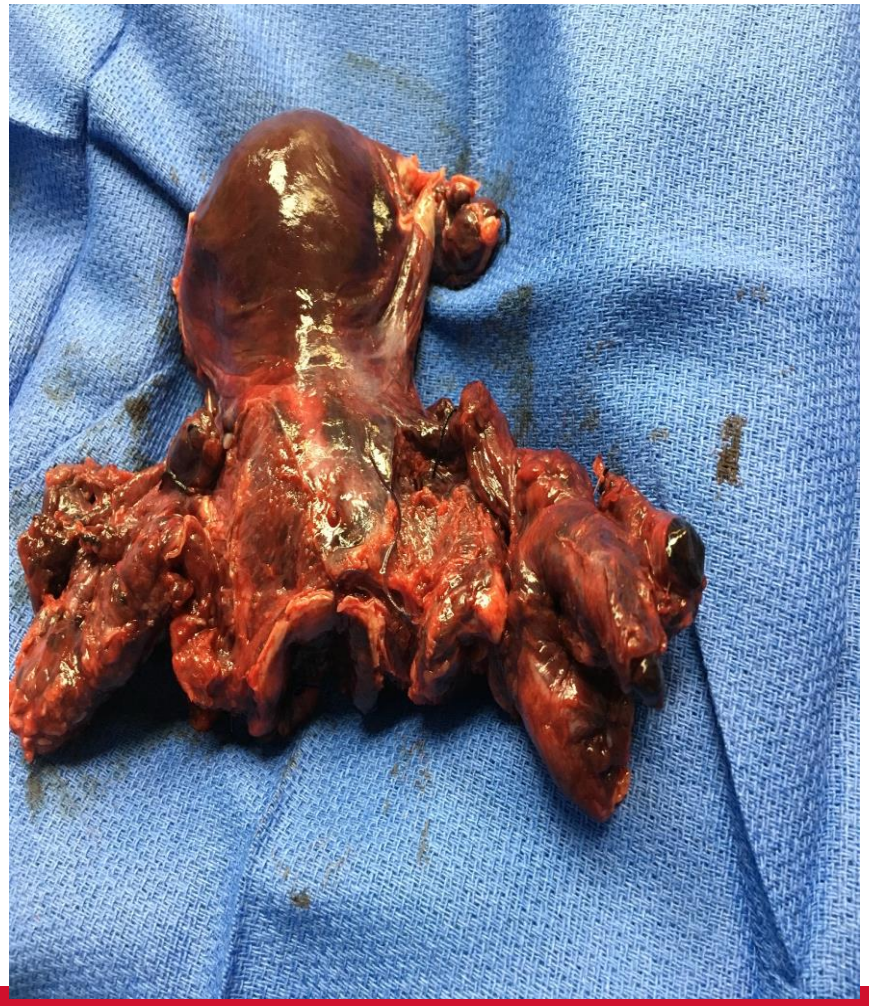


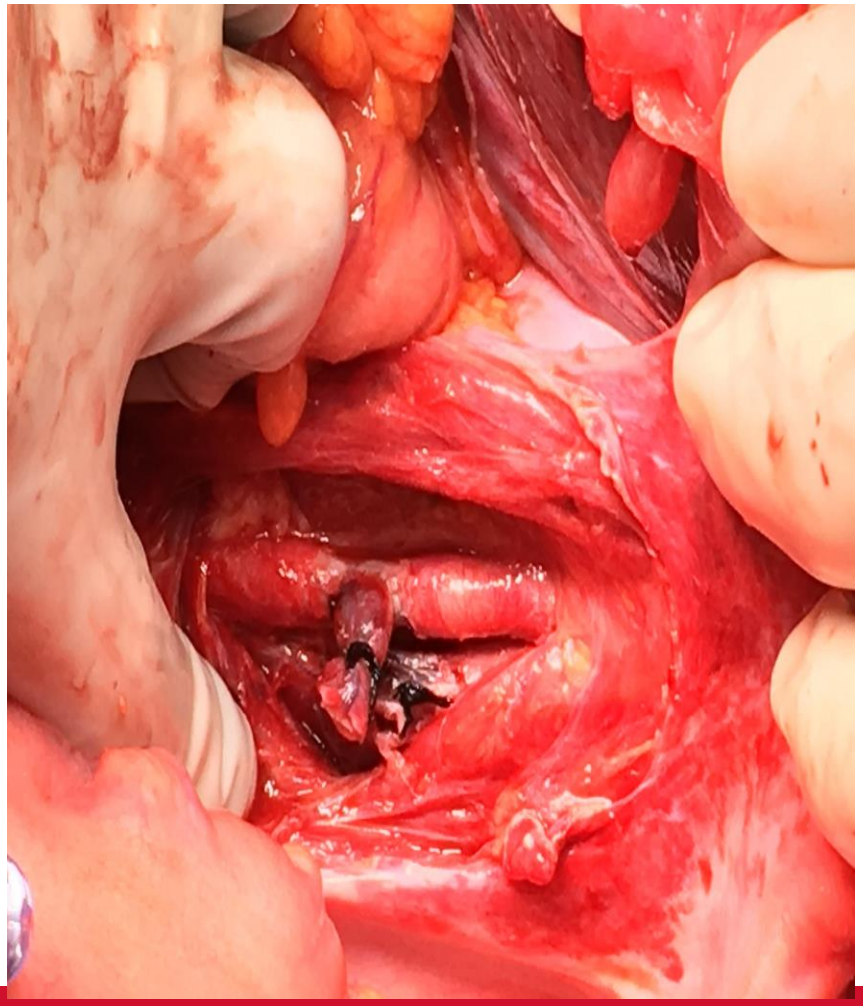
# Challenges- Vaginal anastomosis-resulting in stenosis

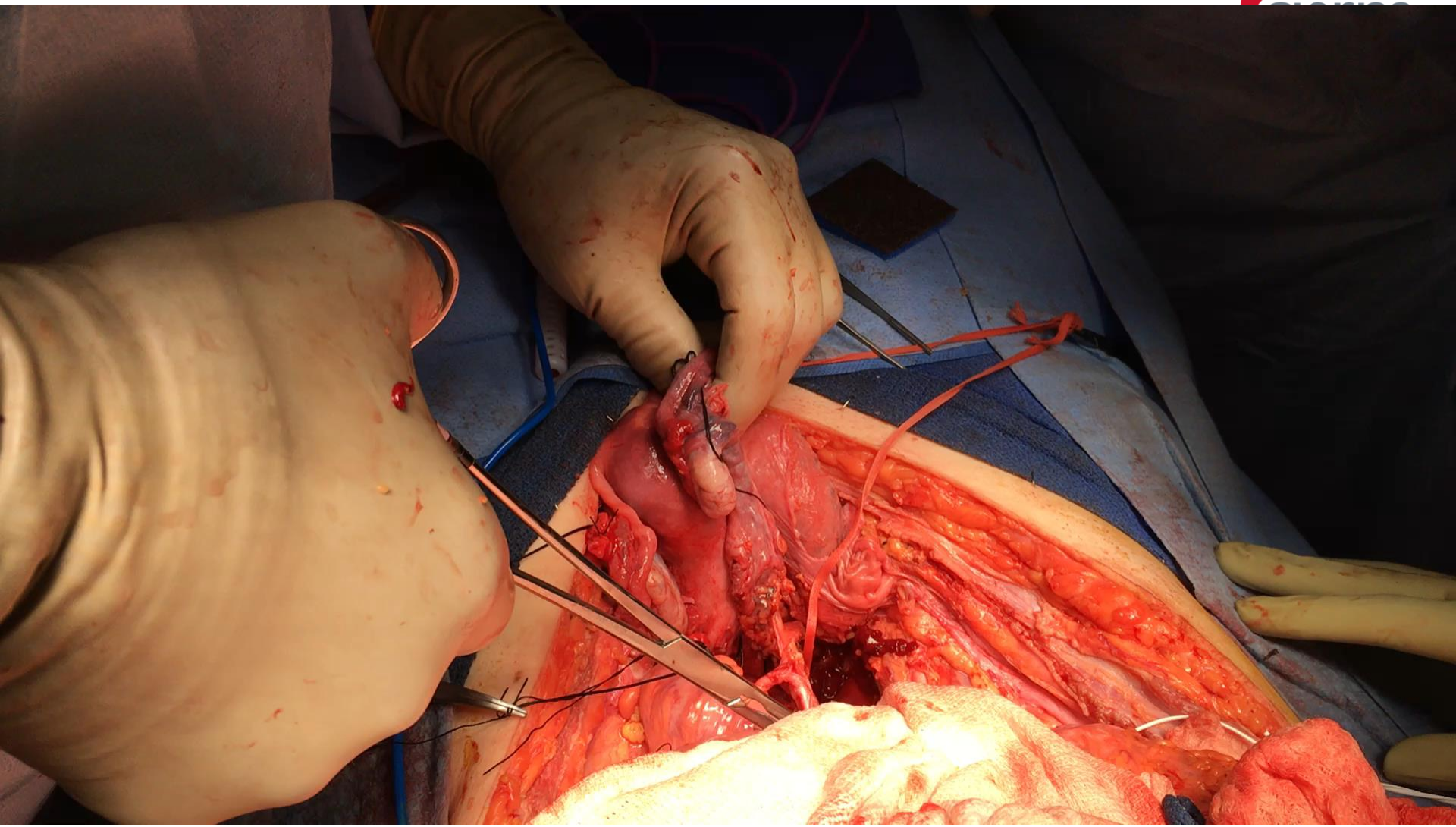
- Adequate vaginal length
  - MRKH- require vaginal dilation before transplant including upper vaginal diameter to accommodate a parous cervix



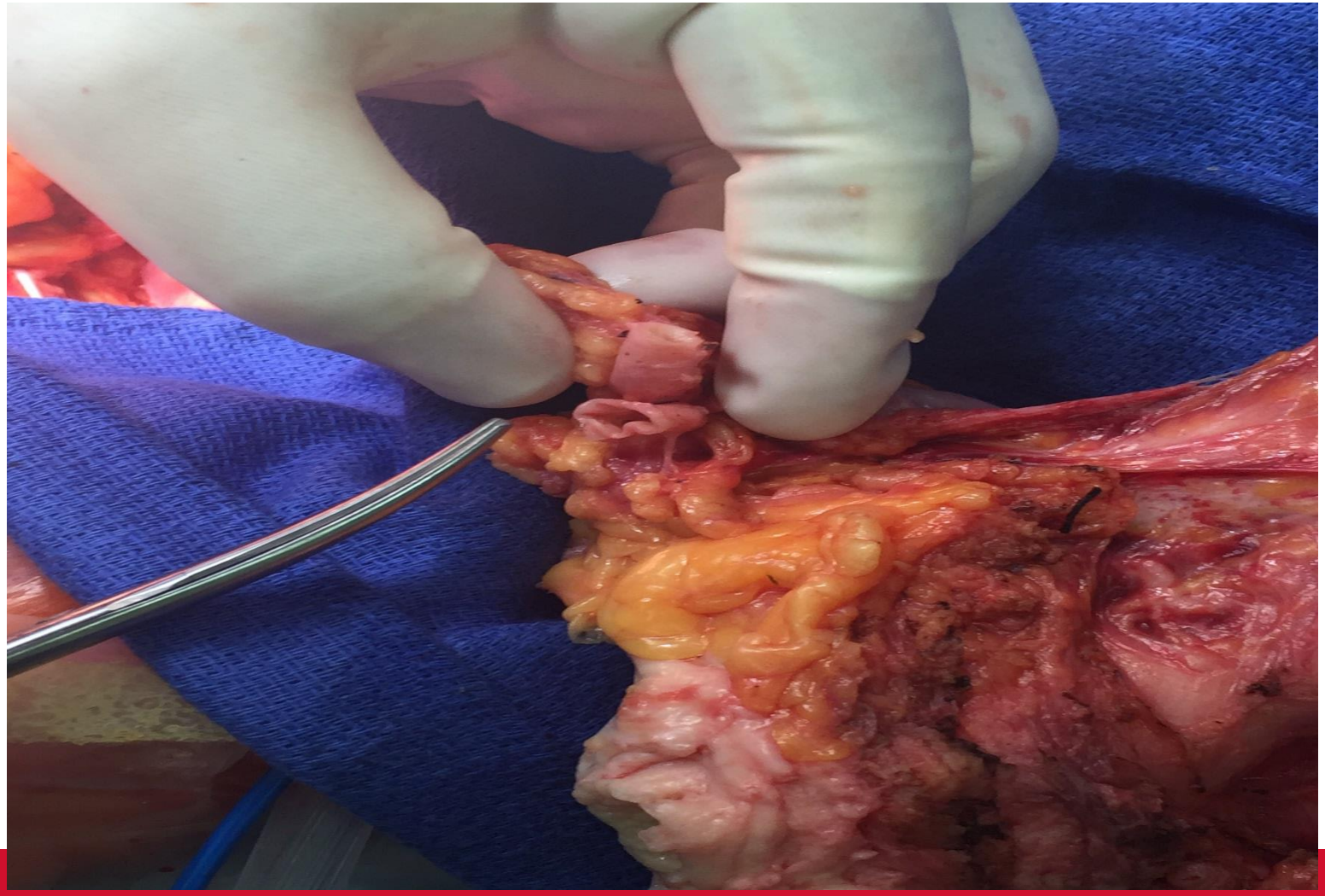


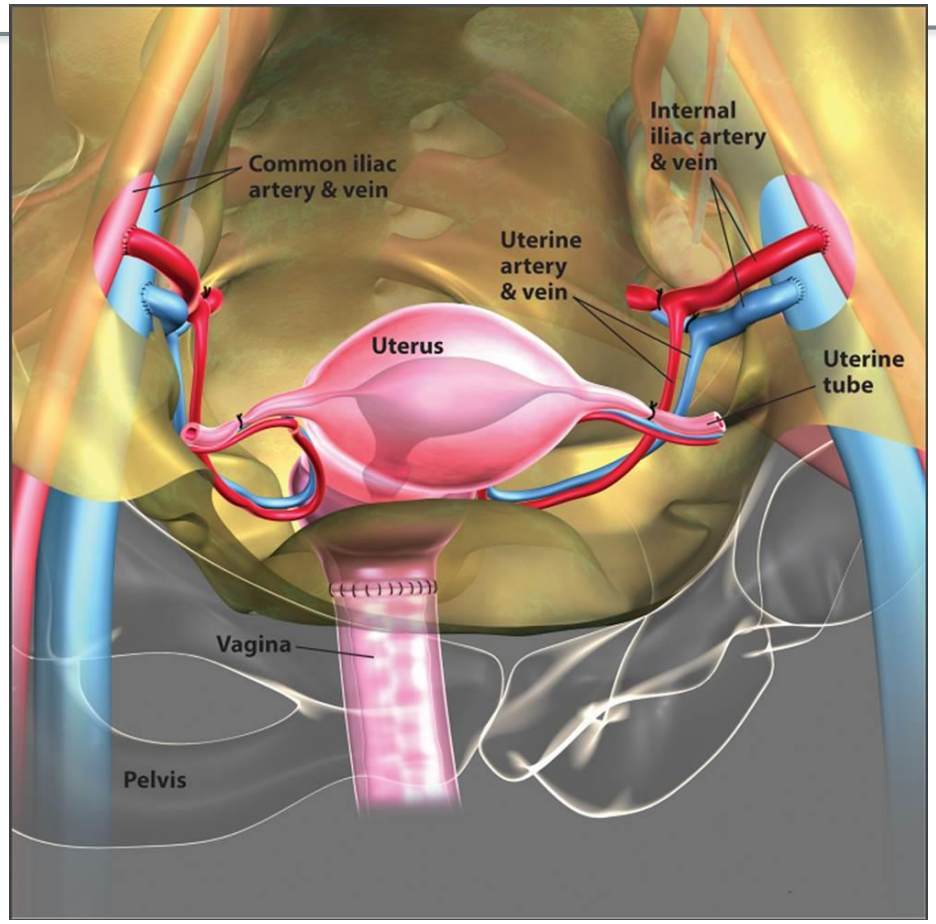




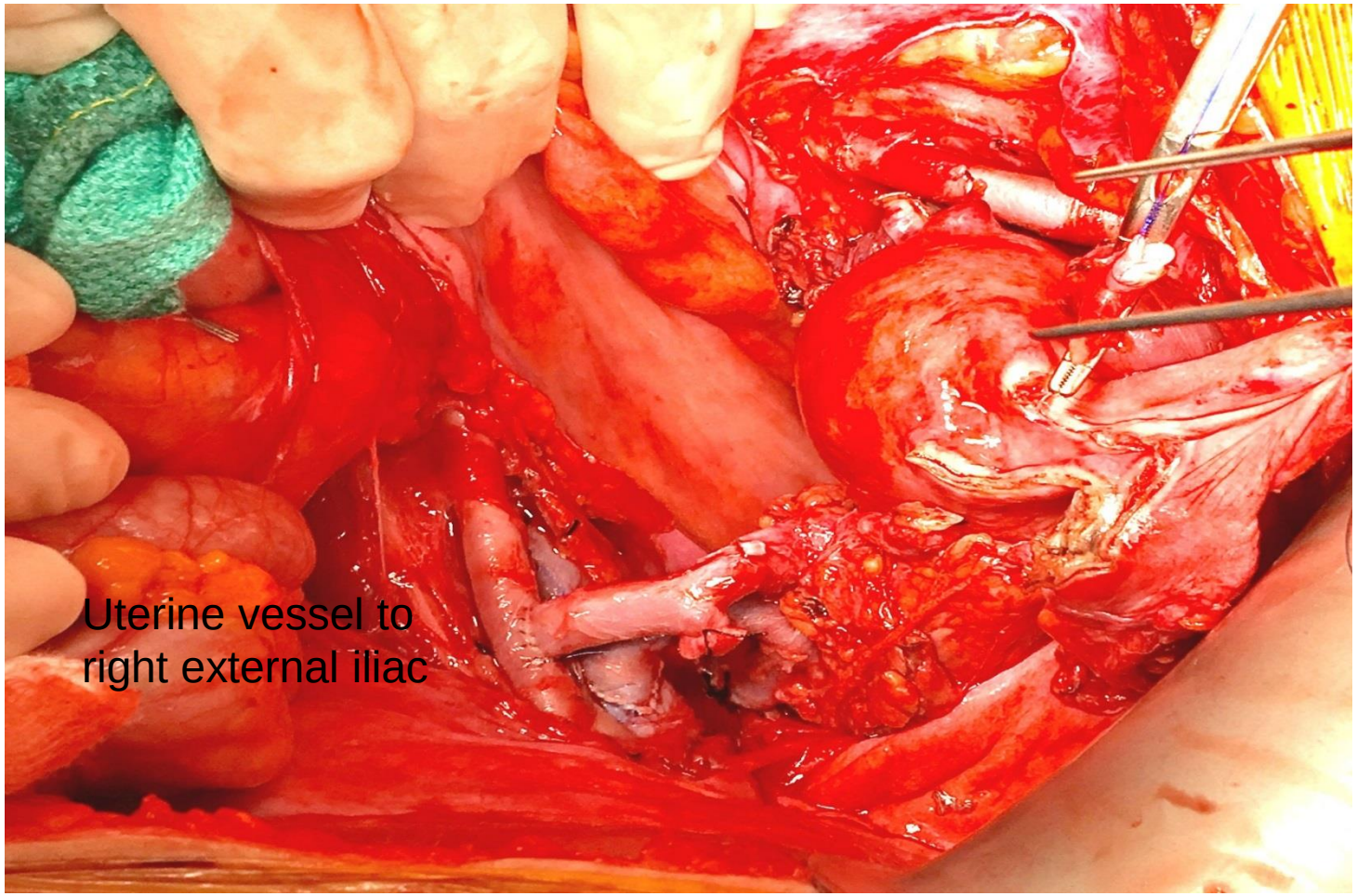


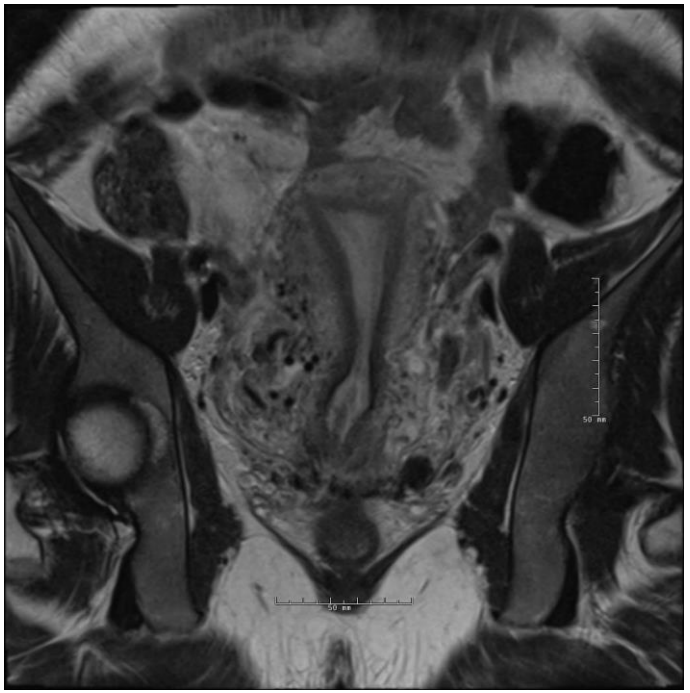
# Diameter of vessels for anastomosis

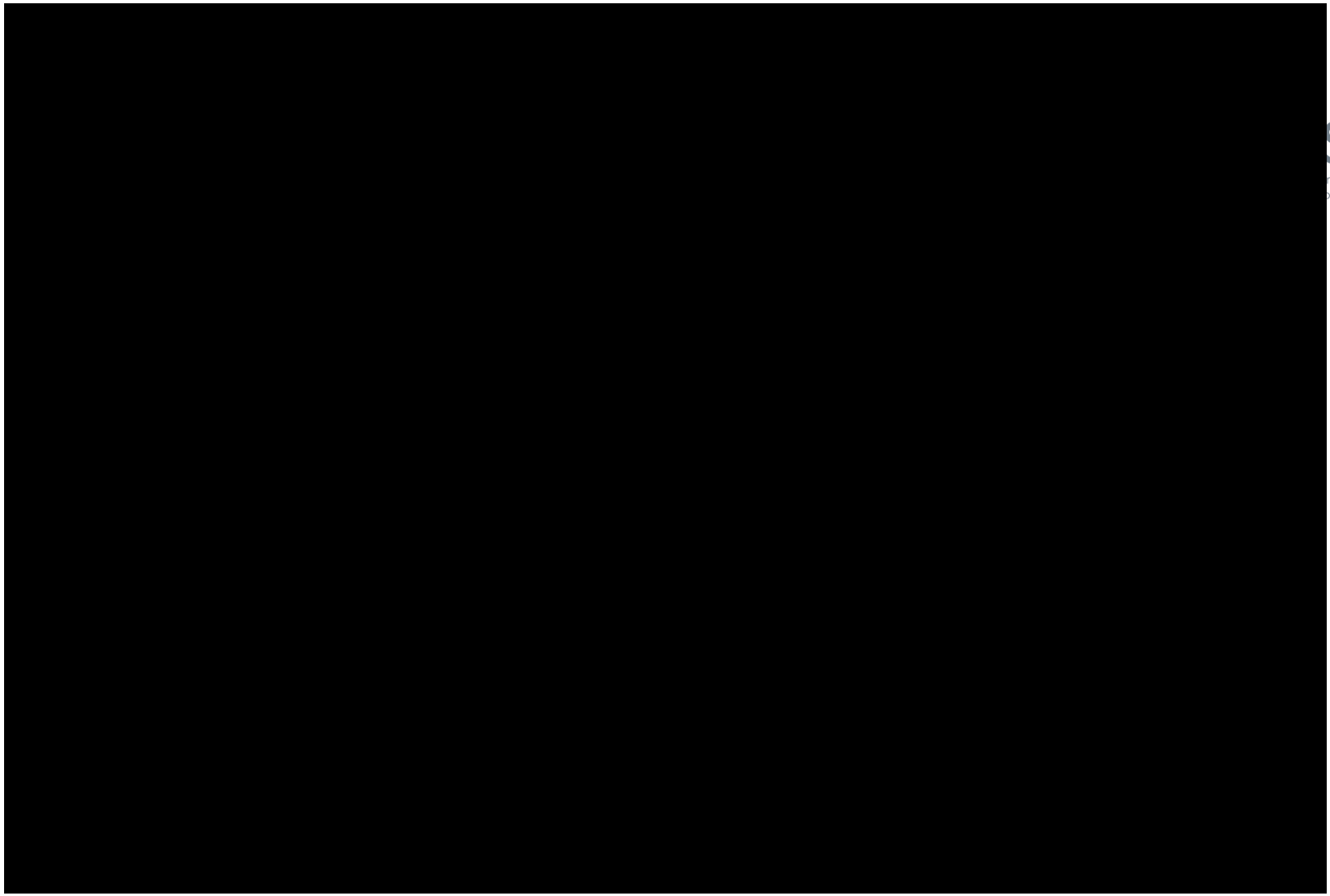



Common iliac artery & vein
Internal iliac artery & vein
Uterine artery & vein
Uterus
Uterine tube
Vagina
Pelvis

# Successful Transplant- Cleveland Clinic







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# Obstetrical Summary

| # Pat | Diagnosis | Gest. Week at Birth | Pregnancy Complication | Birth Weight (±%) | Length (cm) | HC (cm) | Sex | Apgar Score | Instant Outcome (Sept. 2017) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | MRKH Single kidney | 31+6 | Pre-eclampsia | 1775 g -9% | 40 | 28.5 | male | 9-10-10 | Healthy |
| 2 | Cervical cancer | 35+0 | – | 2335 g -7% | 44 | 33 | male | 9-10-10 | Healthy |
| 2b | Cervical cancer | 37+0 | – | 2600 g -13% | 44 | 34 | female | 9-10-10 | Healthy |
| 3 | MRKH | 34+4 | Cholestasis | 2700 g +4% | 46 | 35.5 | male | 8-8-8 | Healthy |
| 4 | MRKH Single kidney | 34+4 | Pre-eclampsia Cholestasis | 3074 g +23% | 47 | 35 | male | 3-7-10 | Healthy |
| 5 | MRKH Single kidney | 35+3 | Pre-eclampsia | 2552 g -4% | 46 | 33.5 | female | 9-10-10 | Healthy |
| 5b | MRKH Single kidney | 35+6 | – | 2745 g -1% | 48 | 34.5 | male | 9-9-10 | Healthy |
| 6 | MRKH | 37+1 | – | 2676 g -12% | 45 | 34 | female | 9-10-10 | Healthy |
| Mean ± SD | | 35+1 | | 2557± 378 | 45± 2.5 | 33.5± 2.2 | 5/8 male | 8-9-10 | |

# Pediatric Result

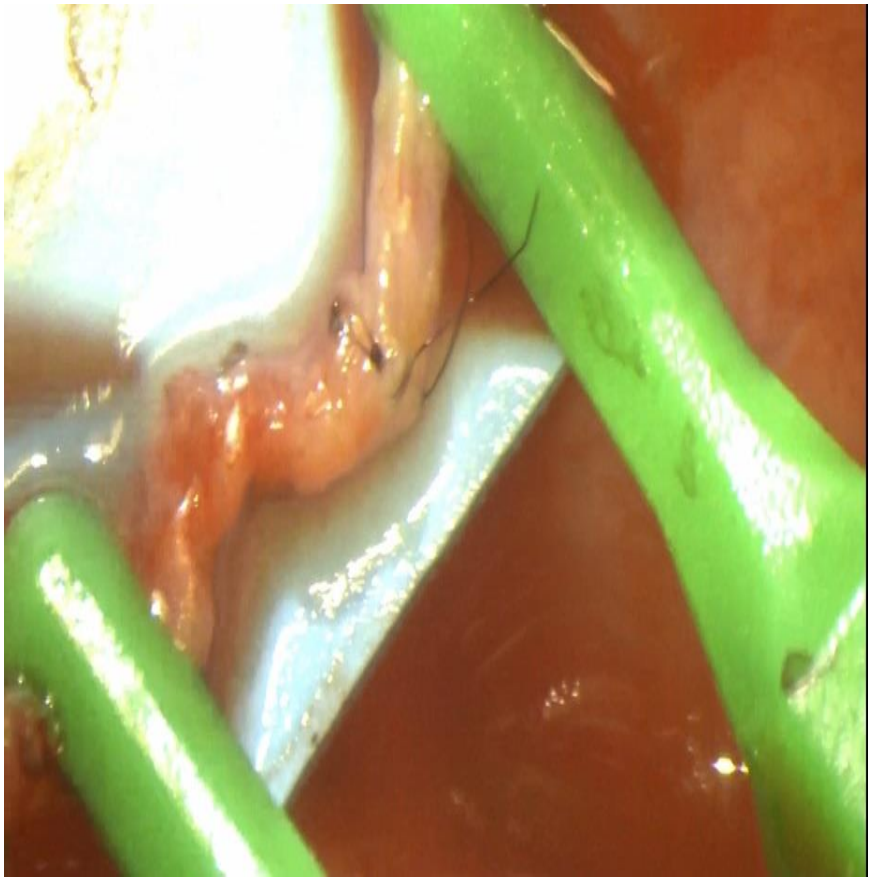
| Weight | Health | Age |
|---|---|---|
| Boy 1775 g -9% w 31+6 | Op ing.hernia | 3 years |
| Boy 2700 g +4% w 34+4 | – | 2 years +10 |
| Boy 2335 g -7% w 35+0 | – | 2 years +10 |
| Boy 3074 g +23% w 34+4 | – | 2 years +3 |
| Girl2552 g -4% w 35+3 | – | 1 year +8 |
| Girl2600 g -13% w 37+0 | – | 8 months |
| Boy2745 g -1% w 35+6 | – | 2.5 months |
| Girl2676 g -12% w 37+1 | – | 2 months |

# Minimally Invasive Approach

- Reported in China
  - Robotic procurement-LD
- The duration of the donor ( 42 year old)- 6 hours "**The uterine and deep uterine veins were difficult to identify and isolate in the donor. We chose only the utero-ovarian veins for venous anastomosis."**
- Recipient surgery was 8 hours and 50 minutes,

# Ongoing research -

- Pursue research to optimize **deceased** donor transplant
  - **Decrease cold** ischemia time?
- Anti-rejection protocols
  - simplify
- Pursue research to optimize recovery in **live donor**
  - Live donors need an alternative venous return



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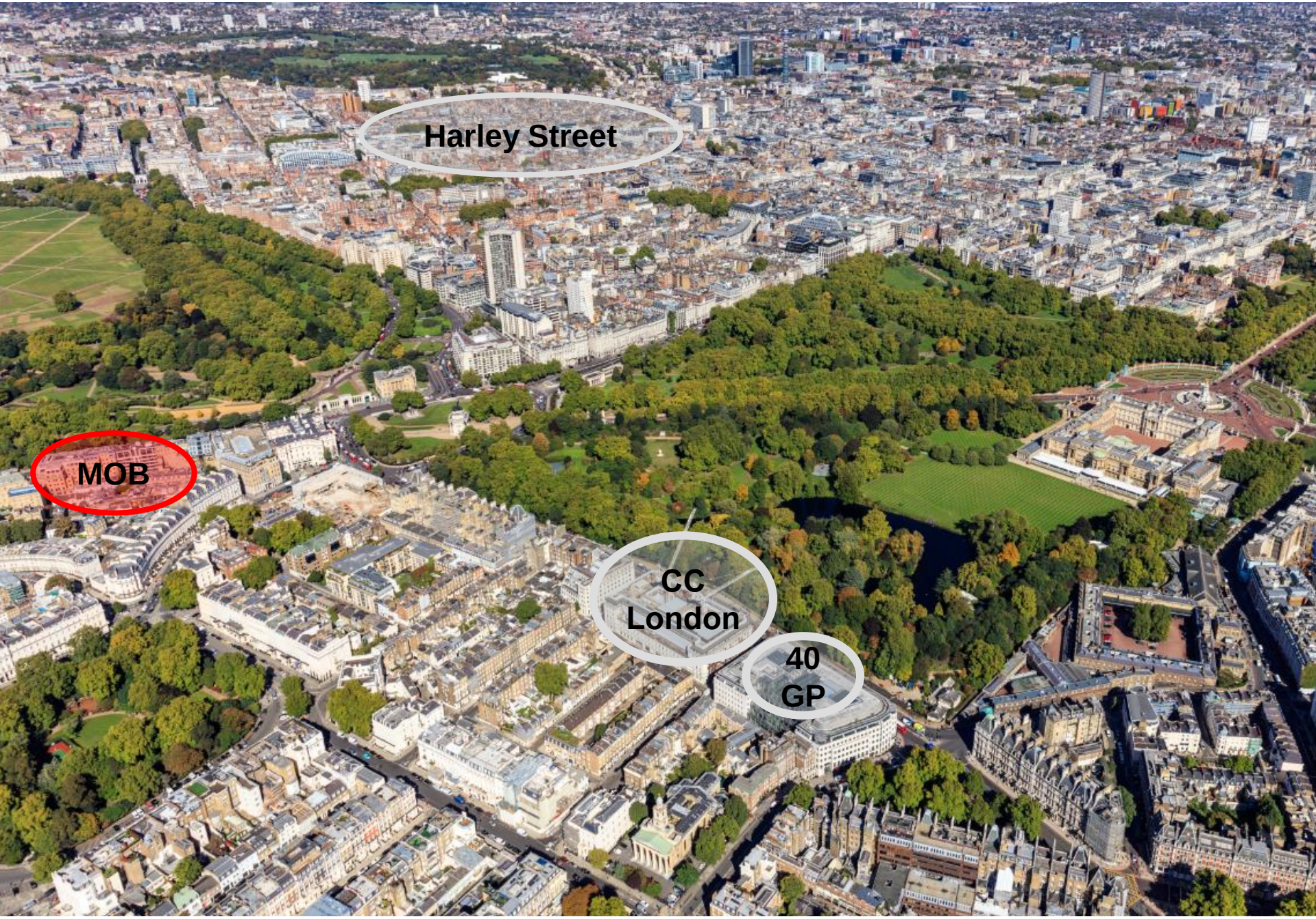
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