腎臟移植外科手術及評估

彰化基督教醫院
泌尿外科　尿失禁暨排尿障礙中心
陳俊吉　醫師

Surgical Related Issues

- Recipient selection
- Donor pool
- Operation procedure
- Immediate post-op care
- Surgical complications

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- Recipient selection
- **Donor pool**
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Donor Pool: Cadaveric

- Standard Criteria Donor : brain death
- Extended Criteria Donor :
  - >60 Y/O
  - >50 Y/O :
    - HTN
    - Cr>1.5 mg/dL
    - CVA/Stroke caused death
- Donation after Cardiac Death
  - Cardiac arrest : 5min
  - Systolic BP<50 mmHg (warm ischemia), 2hours → discard

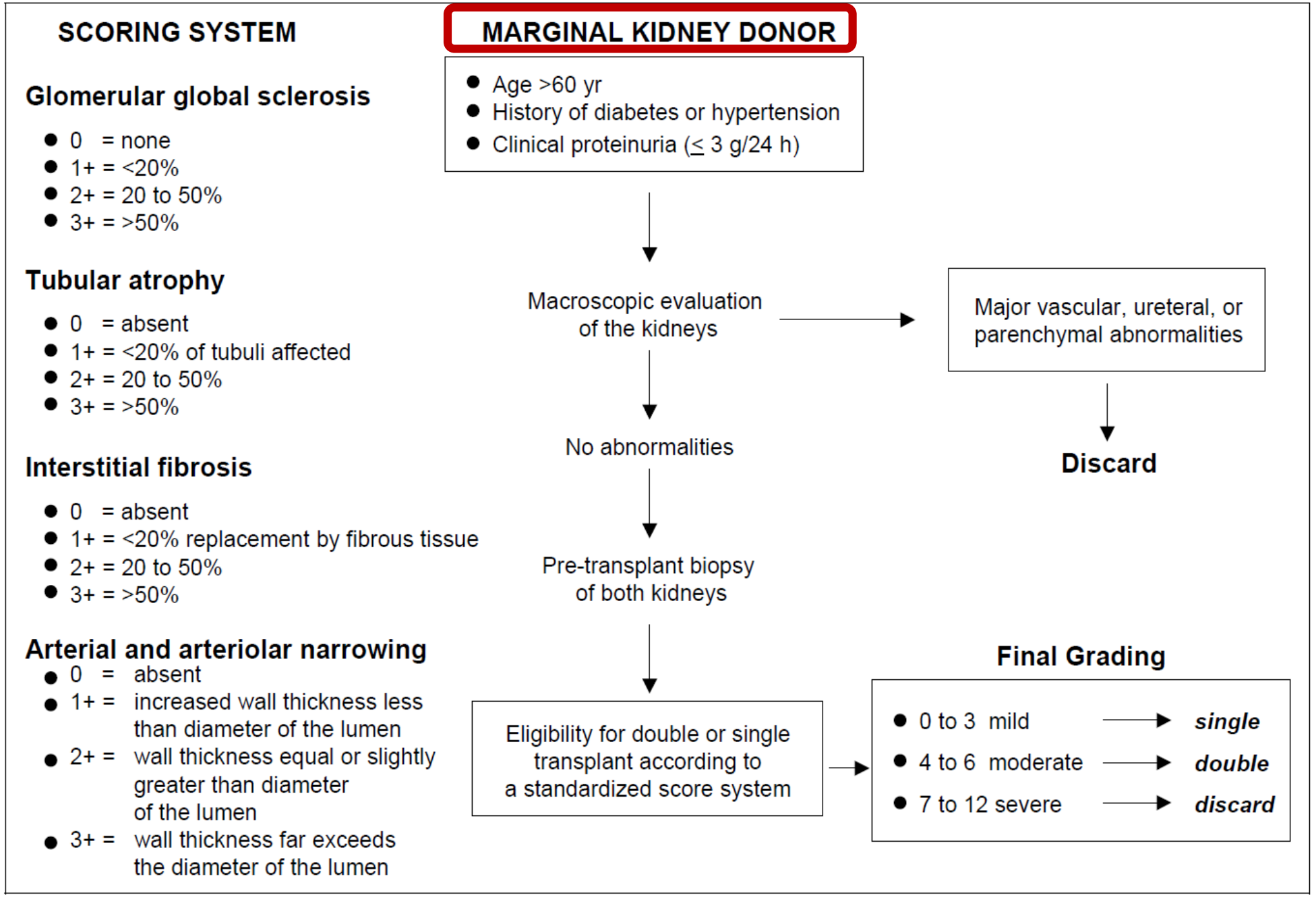
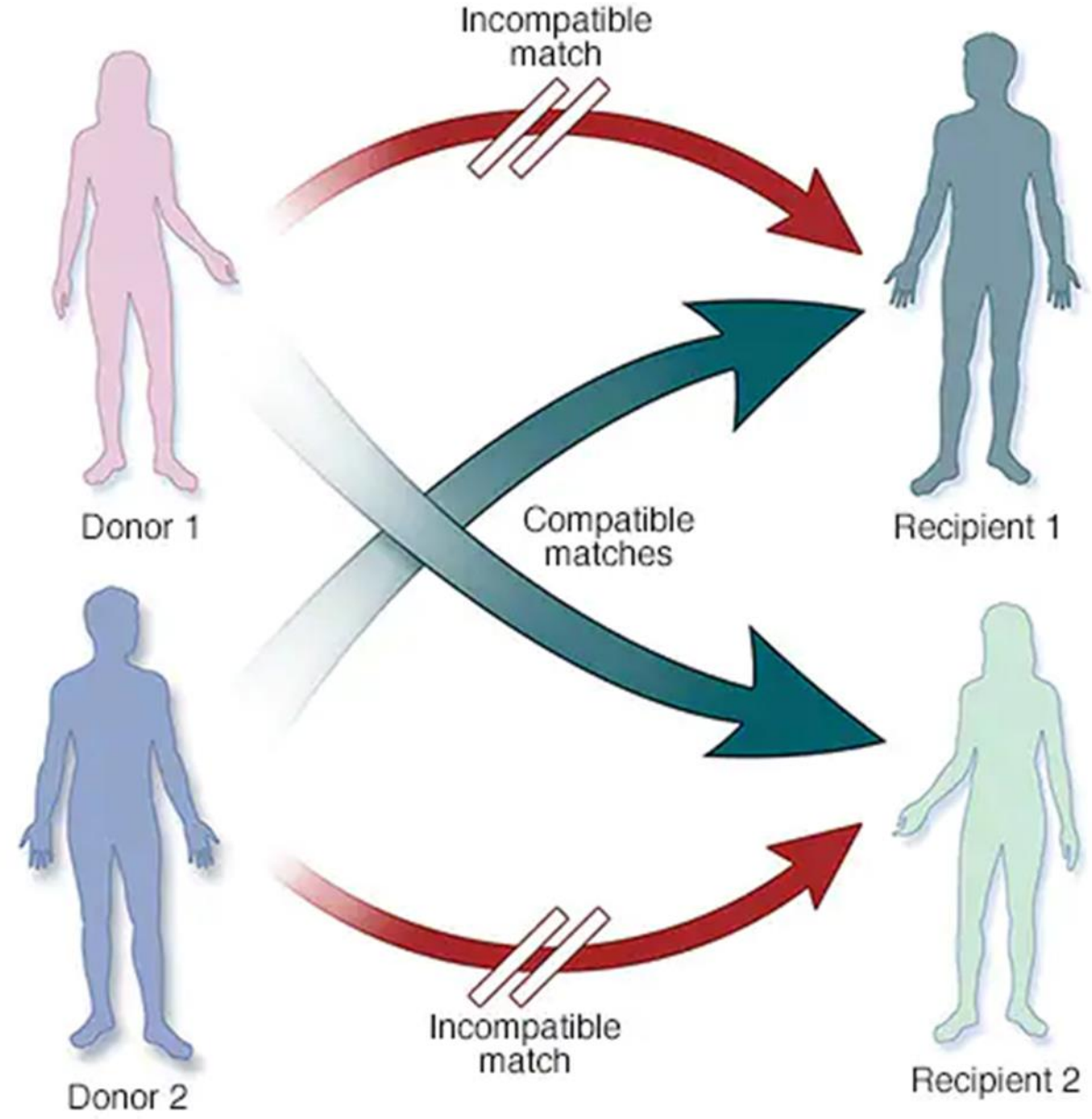


Fig. 2: Proposed algorithm to guide acceptance of single suboptimal or dual marginal kidneys for transplantation, or to discard them.

Donor Pool : Living Donor

- Related : 五等親
- Un-related
- While incompatible :
  - Desensitization
  - Kidney paired donation (paired kidney exchange); 1st in South Korea ,1990s
  - In 2019, 1118 KPD in USA, 16%
  - Taiwan , 2019-2-14, approved



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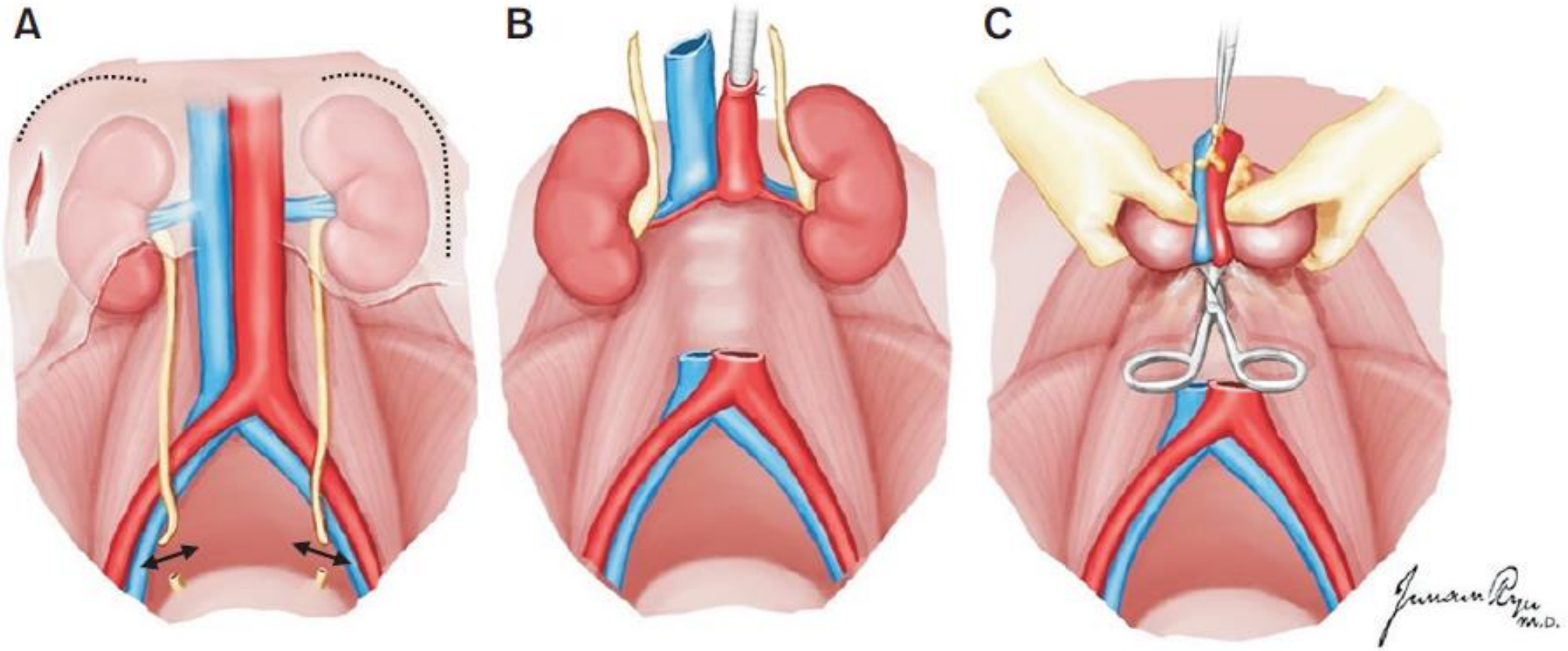
Organ procurement: cadaveric



Organ procurement: cadaveric

En bloc dissection of paired kidneys with aorta and IVC

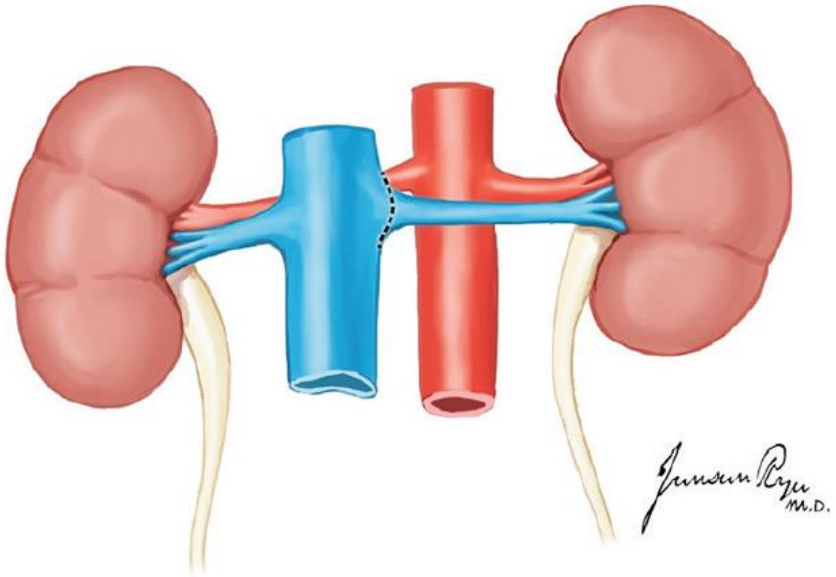


Fig. 21. The left renal vein is identified and divided at its junction with the inferior vena cava.

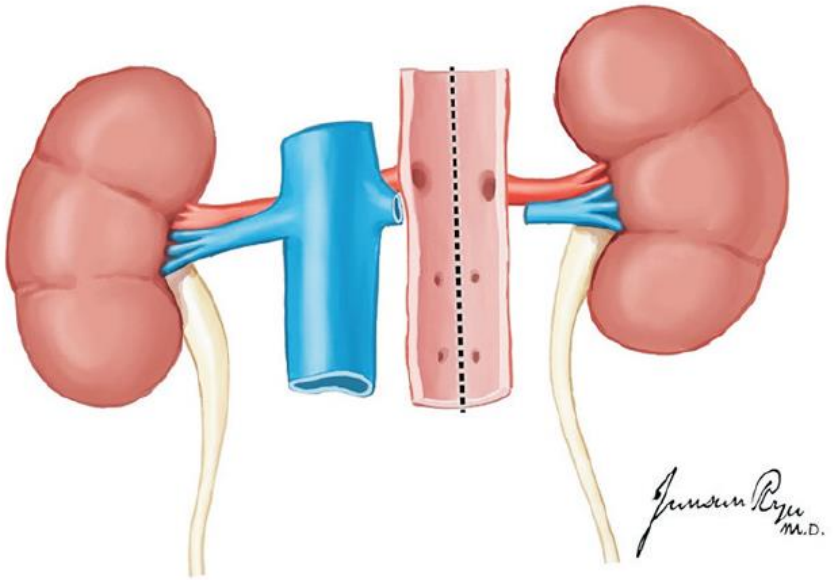
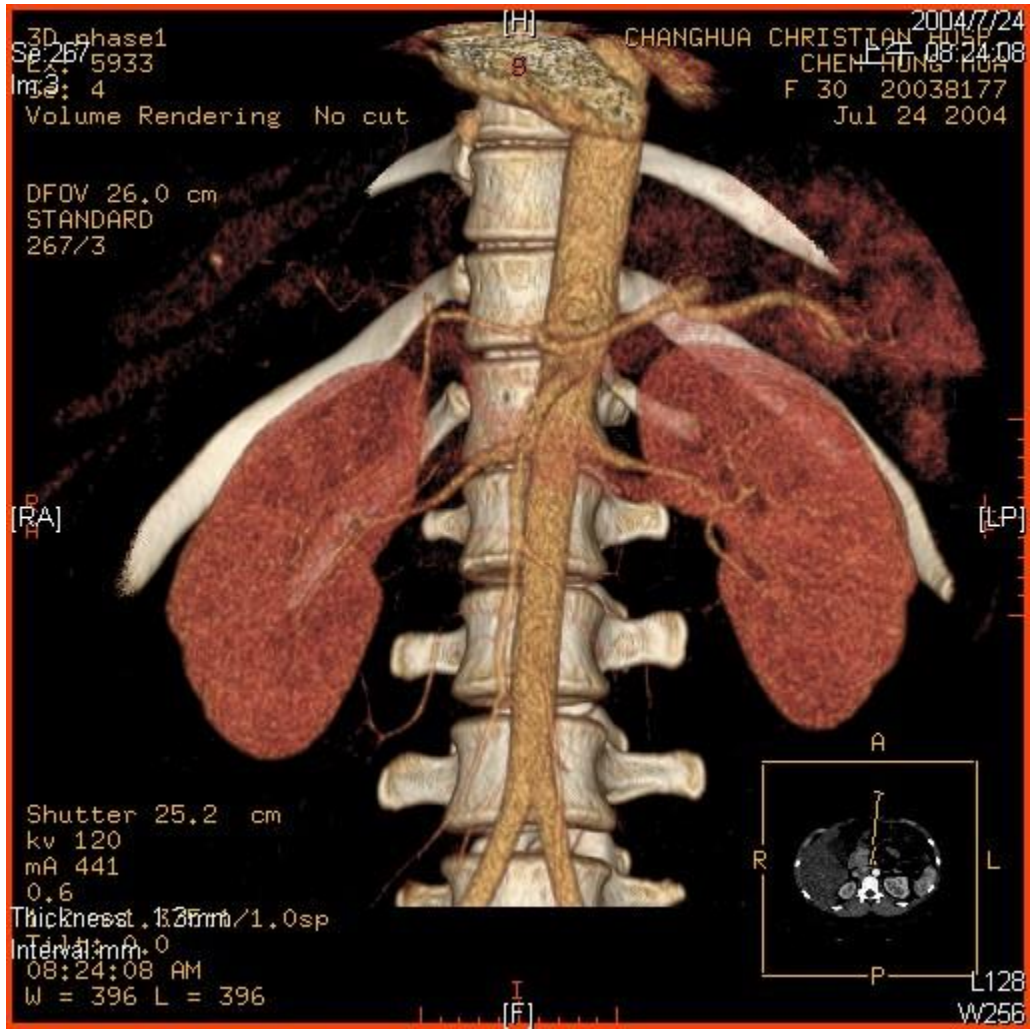


Fig. 22. The aortic wall is divided longitudinally down its center aspect, which allows for inspection of the renal artery orifices.

Living Donor Nephrectomy

- Pre-op evaluation
  - Routine blood test
  - Renal function evaluation : GFR
  - 3D CT angiography : accessary ; polar ; branching
  - Side selection

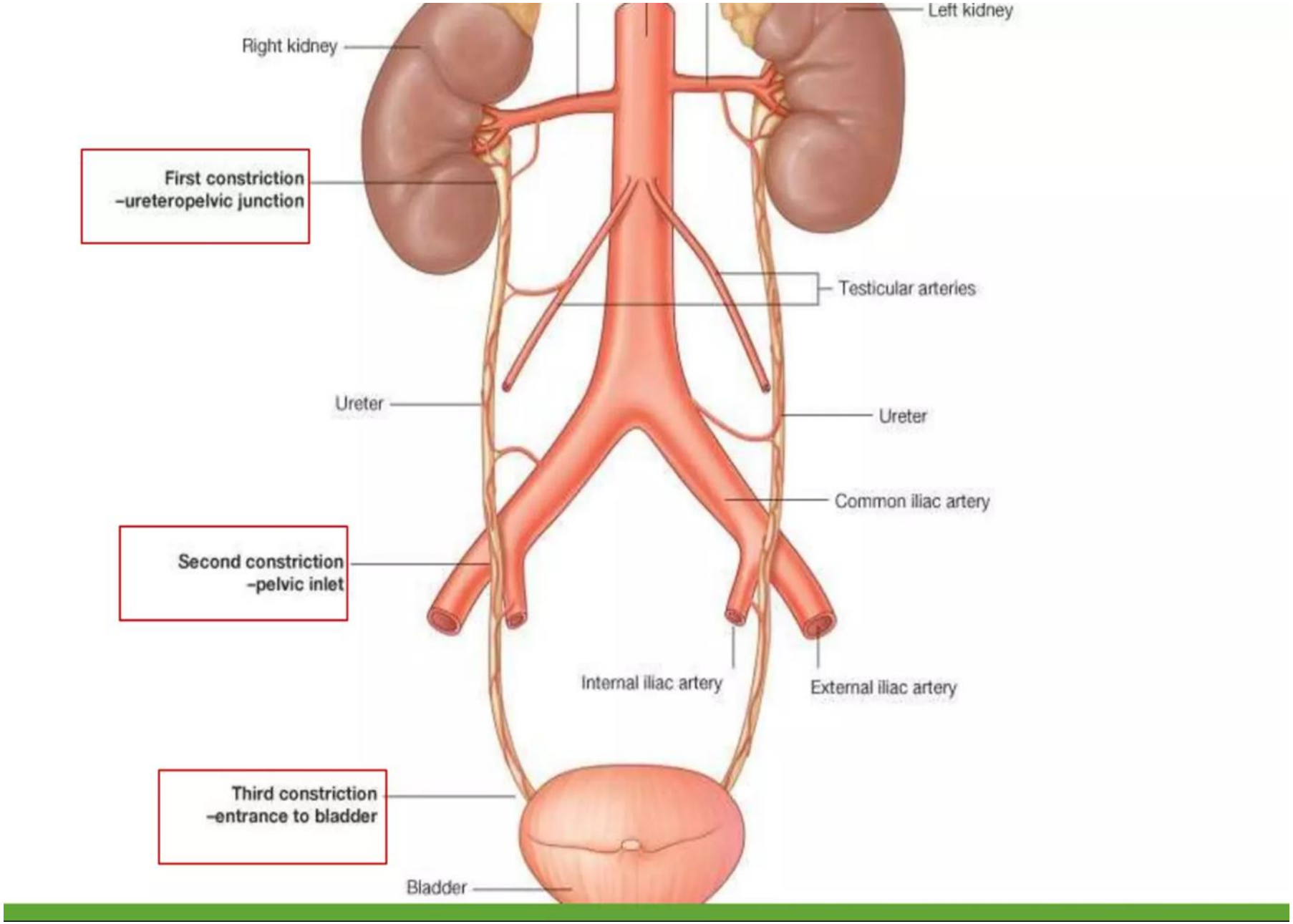


3D CT angiography

Cautions

- Periureteral and perihilar fat should be left in situ-→ lymph leakage
- Gold triangle : between upper ureter and renal hilum

↳ **ureter blood supply**


Left kidney
Right kidney
First constriction
–ureteropelvic junction
Testicular arteries
Ureter
Ureter
Common iliac artery
Second constriction
–pelvic inlet
Internal iliac artery
External iliac artery
Third constriction
–entrance to bladder
Bladder

Organ Preservative Solution

- Maintain the organ in optimal condition from the time of explantation until transplantation
- 4 major advantages to a transplant program
  - Time to transport the organ
  - Time to allow tissue matching
  - Time to prepare the recipient and surgical team
  - Quality of graft function : better post-op recovery

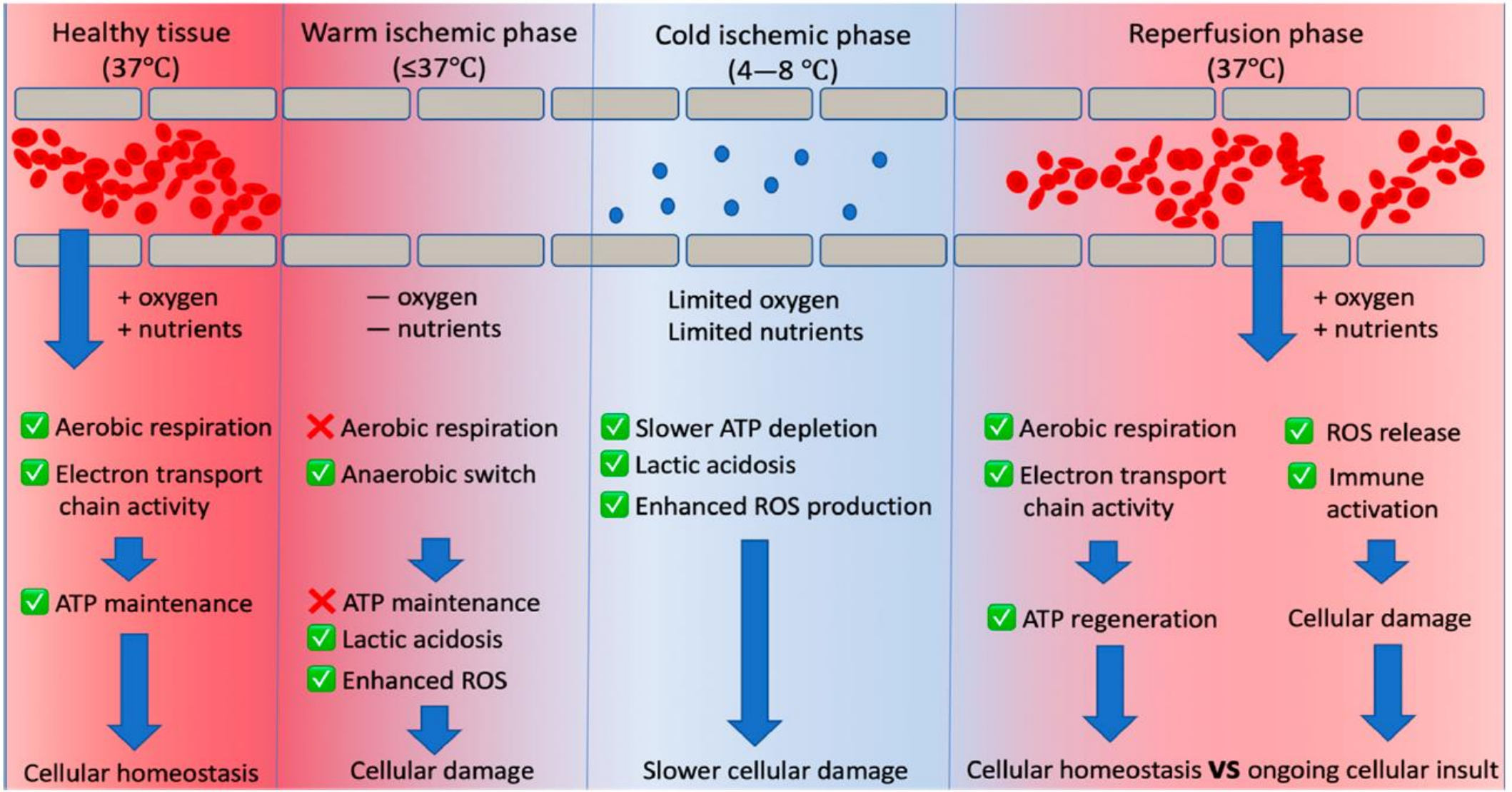
Organ Preservative Solution

- Provide for hypothermia
- Prevent cellular swelling
- Avoid biochemical injury

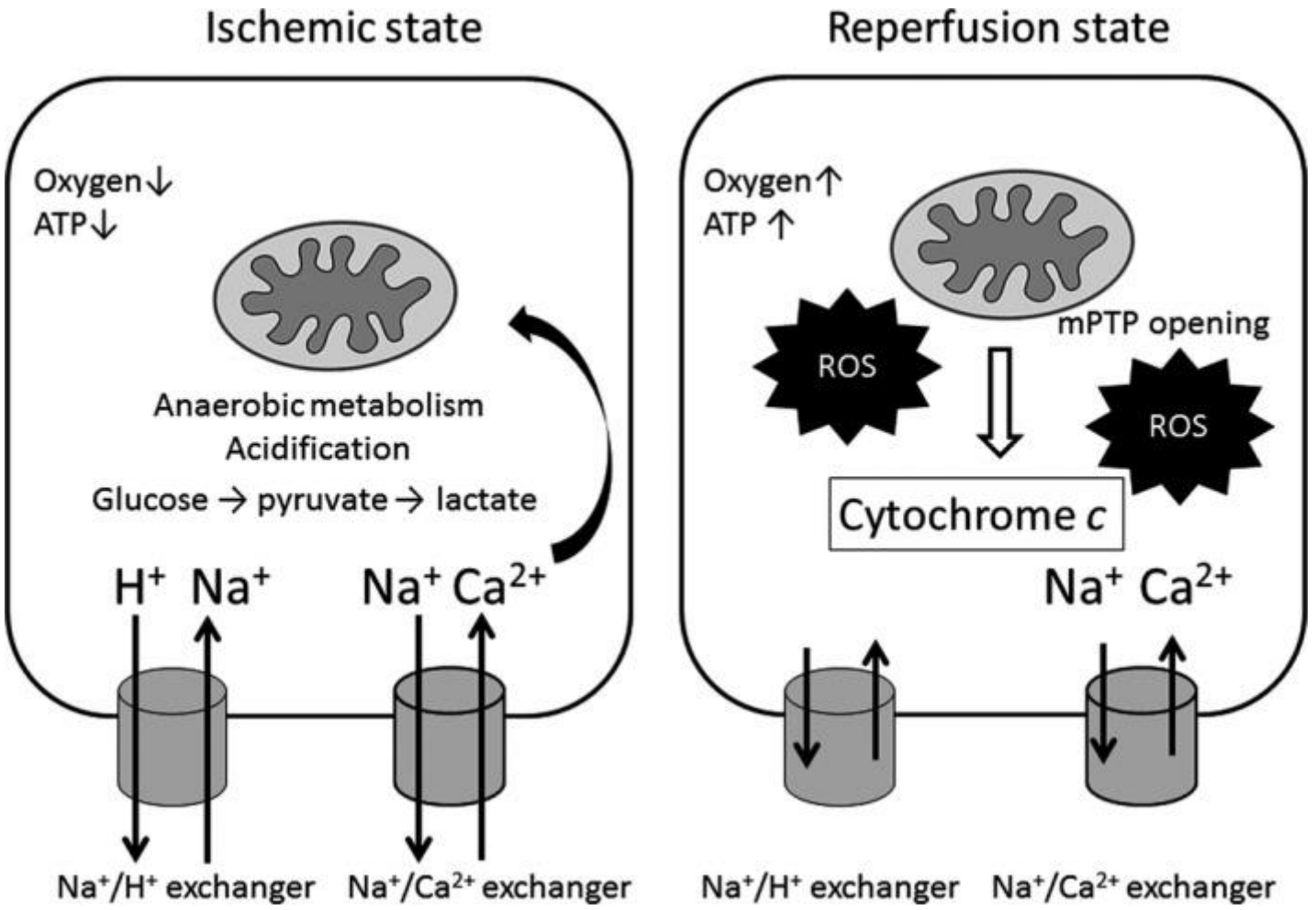
Organ Preservative Solution

- **H**istidin-**T**ryptophan-**K**etoglutarat Solution
- **U**niversity of **W**isconsin Solution
- **Celsior** Solution

Ischemia and Reperfusion



Cytosolic and Mitochondrial Function

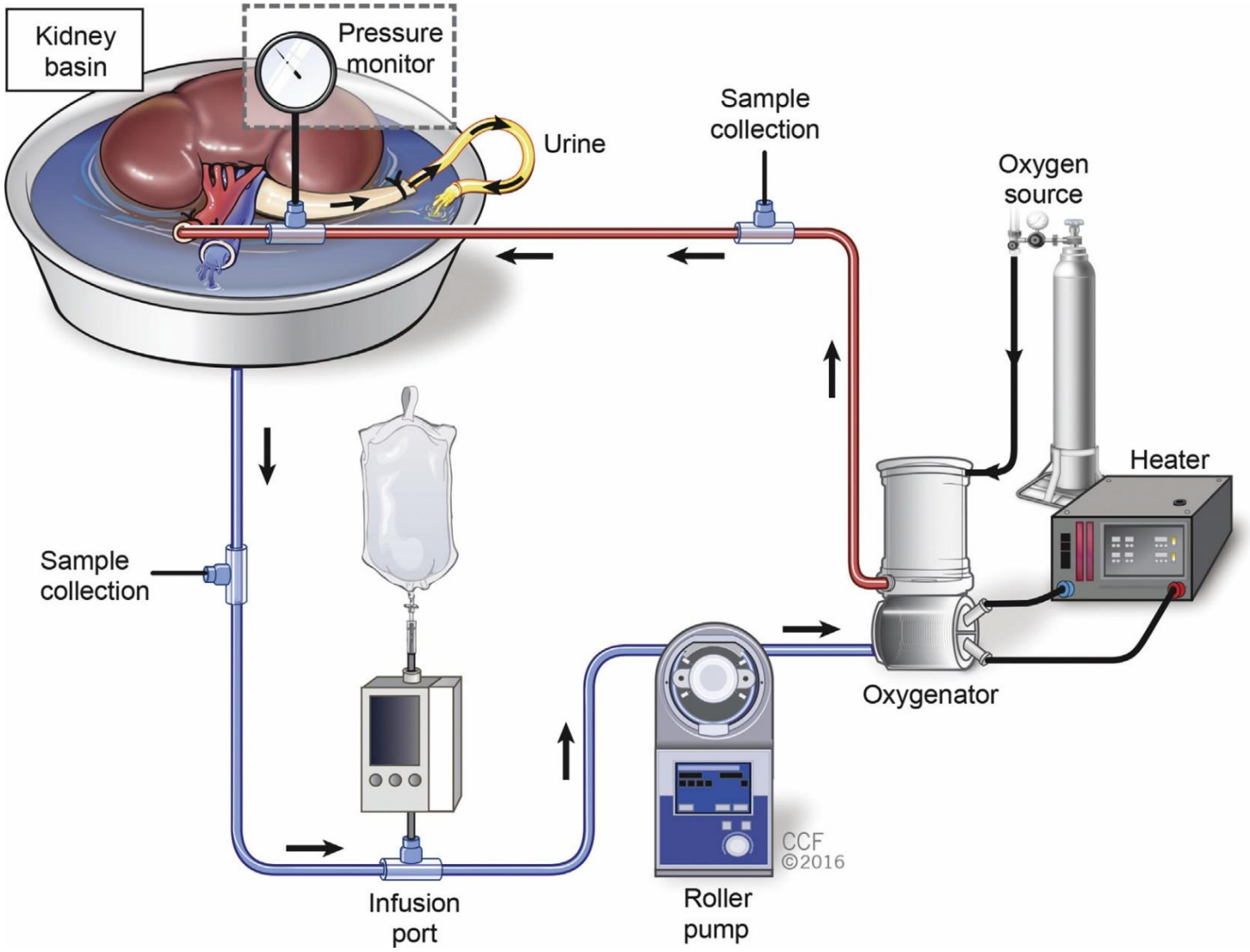


ROS: reactive oxygen species

Prevention of IRI

- Reduce hypoperfusion time
- Machine perfusion organ storage
- Therapeutic gases : Nitrogen MonoOxide
- Antioxidant agents: SuperOxide Dismutase
- Cell therapy :
  - mesenchymal stem cells
  - regulatory T cells

Prevention of IRI



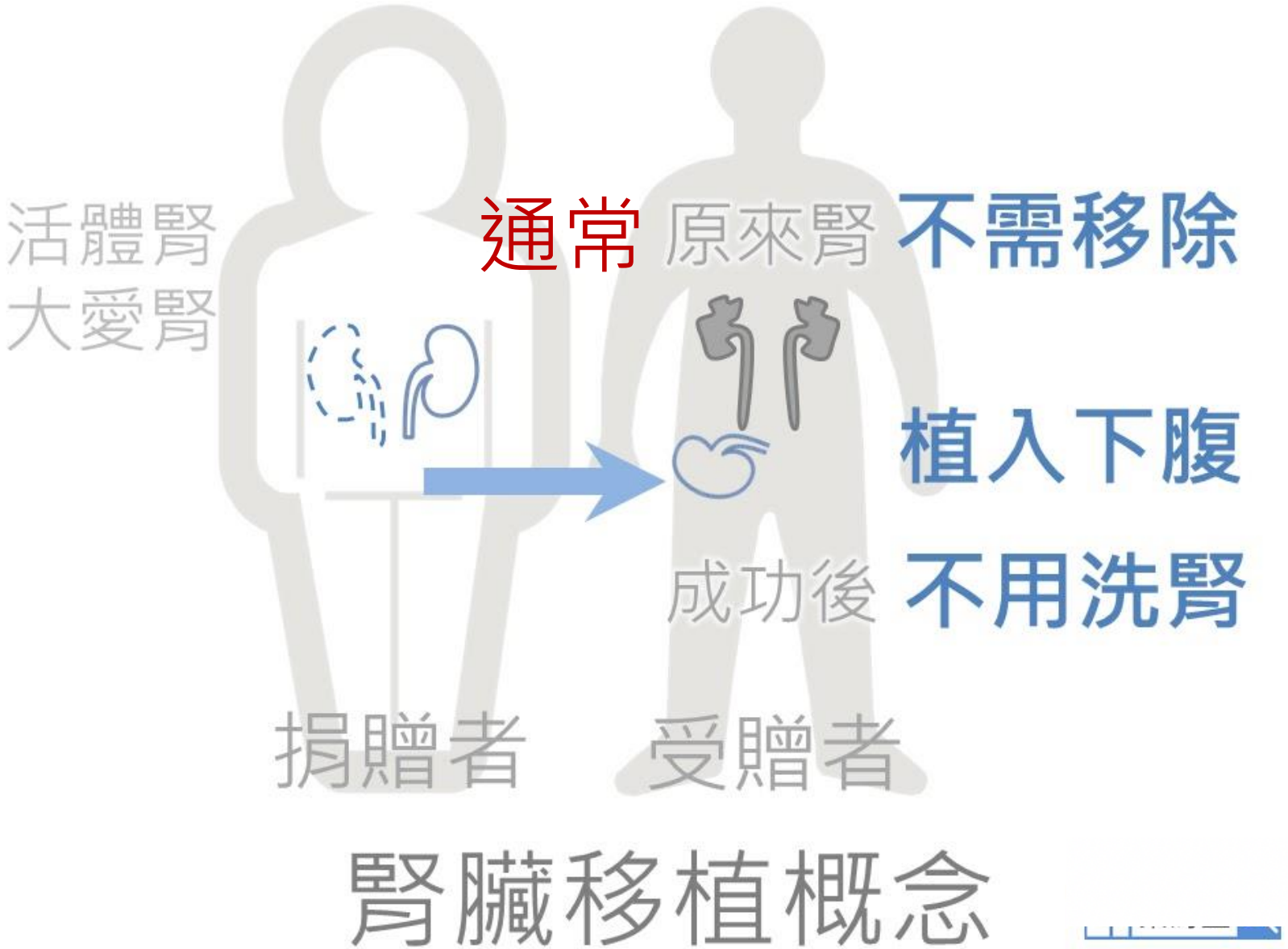
陳俊吉——😟覺得壓力大。

2月15日 ·

活體移植真的壓力山大
捧在手心呼喚它醒來
沒尿出來不敢下table

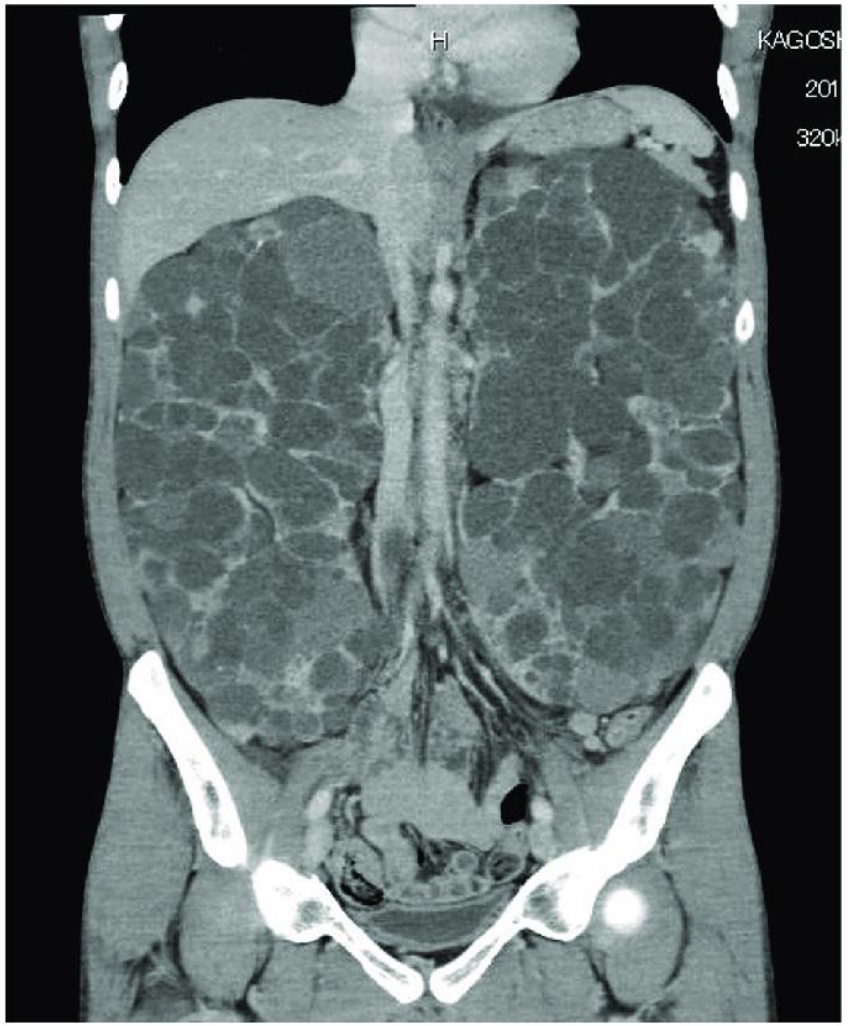
30則留言

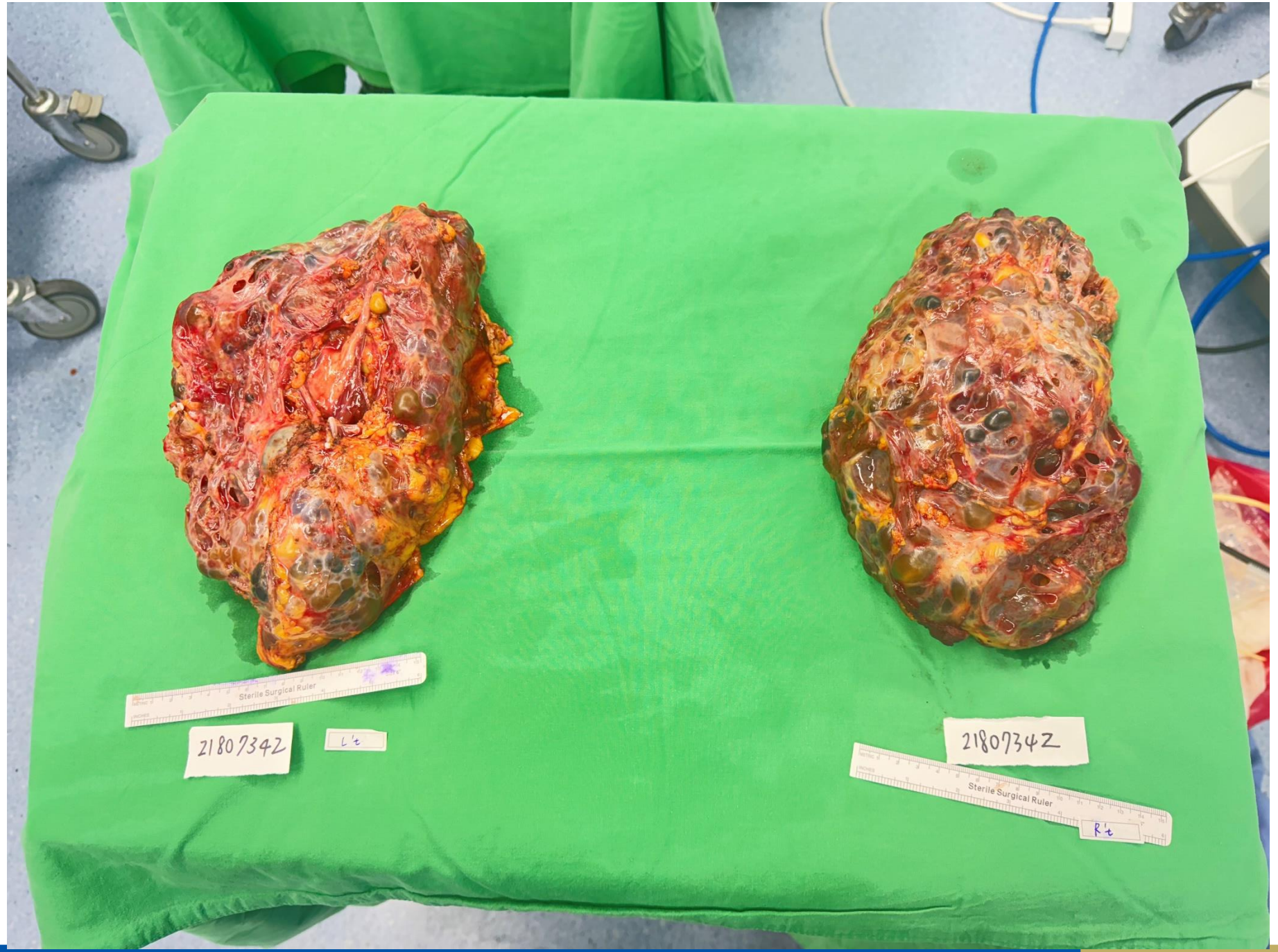
讚 留言 分享


活體腎
大愛腎
通常 原來腎 不需移除
植入下腹
成功後 不用洗腎
捐贈者
受贈者
腎臟移植概念

Time for Native Nephrectomy

- Less space for implant: polycystic kidney disease (PCKD)
- Infection
- Infected urolithiasis
- Heavy proteinuria
- Renovascular hypertension
- Hemorrhage
- Suspect malignancy




Sterile Surgical Ruler
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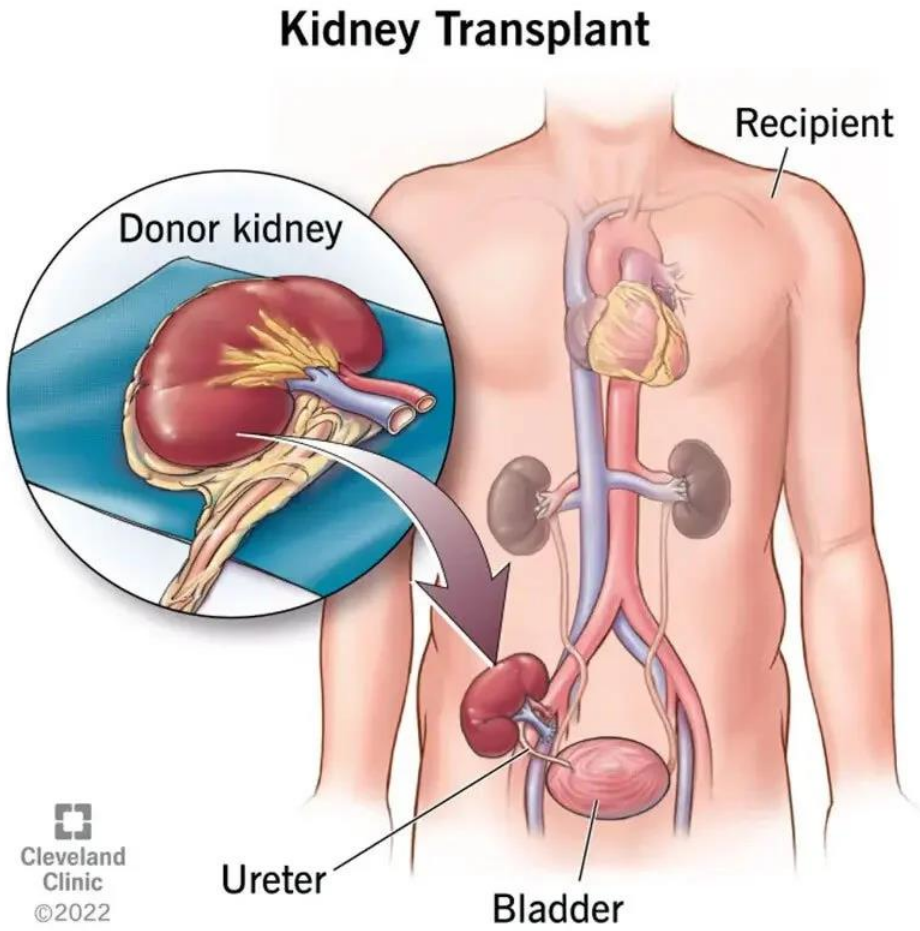
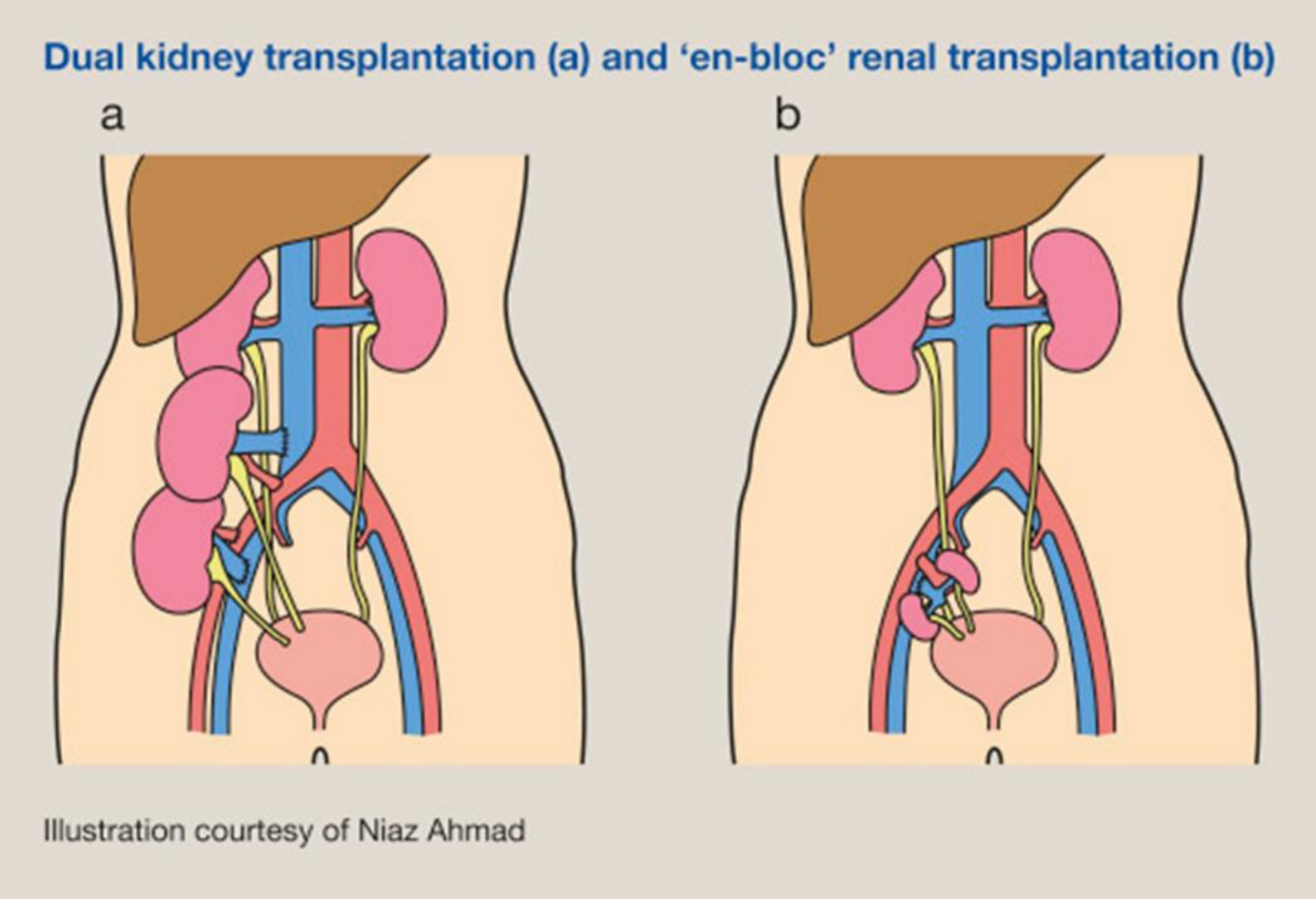
Procedure : Graft implant

- Graft implant
  - Extraperitoneal
  - Iliac fossa
  - Vessel anastomosis: end-to-side (sometimes end-to-end)
  - Ureteral implant
  - Dual transplant



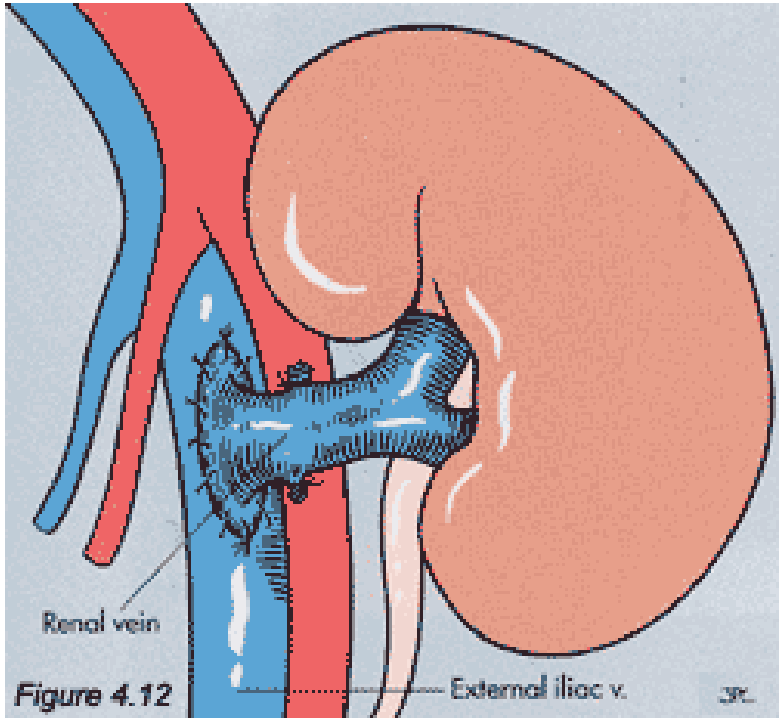
Procedure : Graft implant

- Dual transplant



Venous anastomosis

- Left graft kidney: anastomosed with a cuff of vena cava end-to-side to the external iliac vein



Venous Anastomosis

- right graft kidney:
  - anastomosed directly
  - usually with a cuff of vena cava
  - multiple veins: bifurcated vein graft can be used, or one vein can be ligated

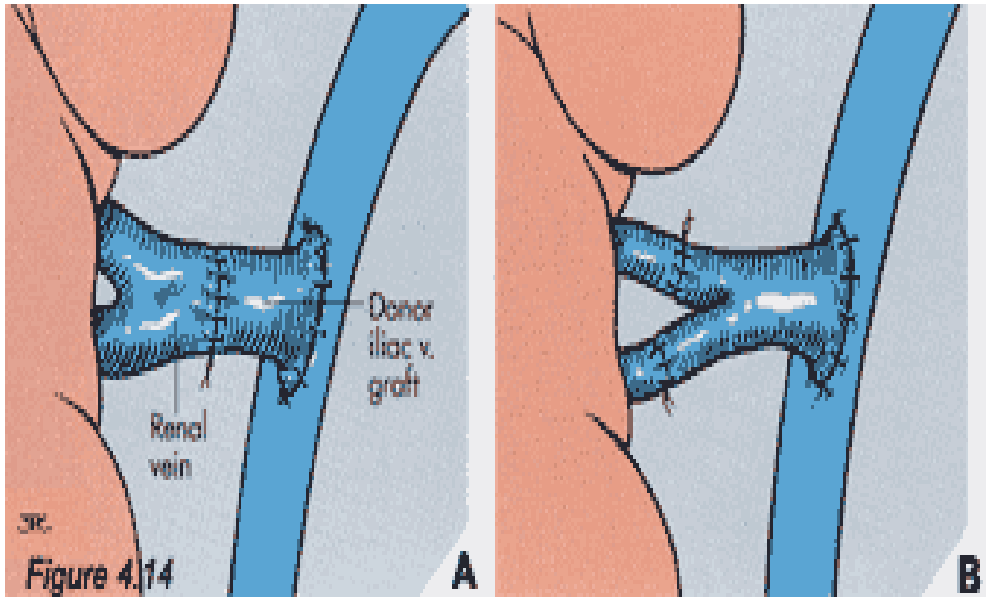


Figure 4.14

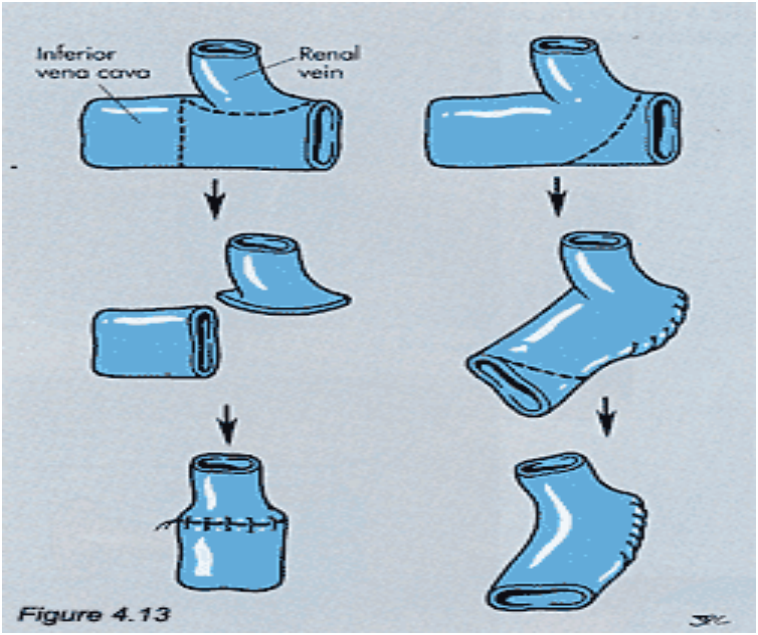
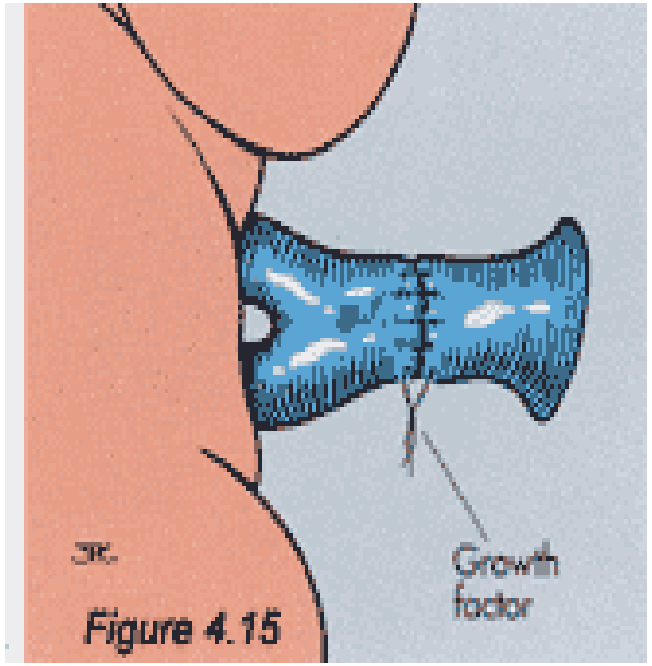


Figure 4.13

Venous anastomosis

- "growth factor" is used while tying, on completion of the anastomosis, to prevent stricture.
- continuous nonabsorbable monofilament suture is used.



Arterial Anastomosis

- Renal artery usually is anastomosed with a cuff of aorta end-to-side to the external iliac artery
- it may also be sewn end-to-end to the internal iliac artery.

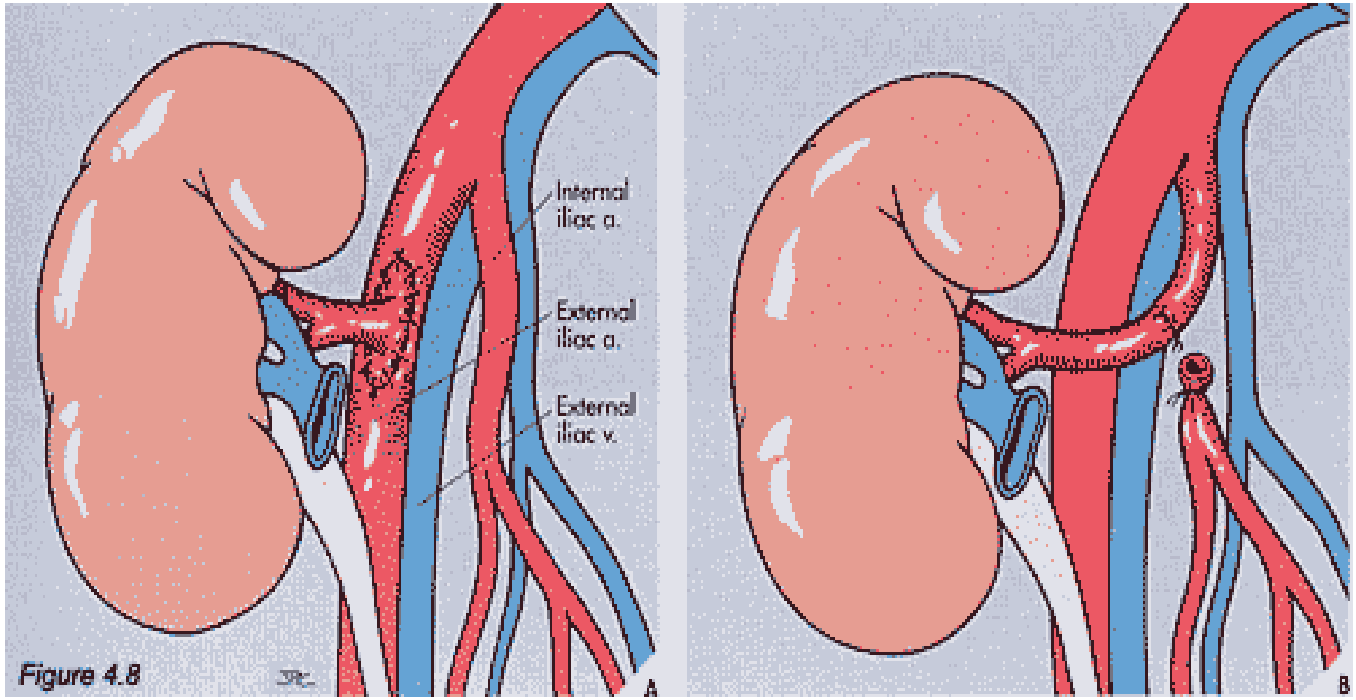


Figure 4.8

Arterial Anastomosis

Multiple arteries

- If the arteries are on a cuff of aorta: a long cuff, or two smaller cuffs
- If a polar artery has been transected:
  - anastomosed on the back table to the side of the main renal artery

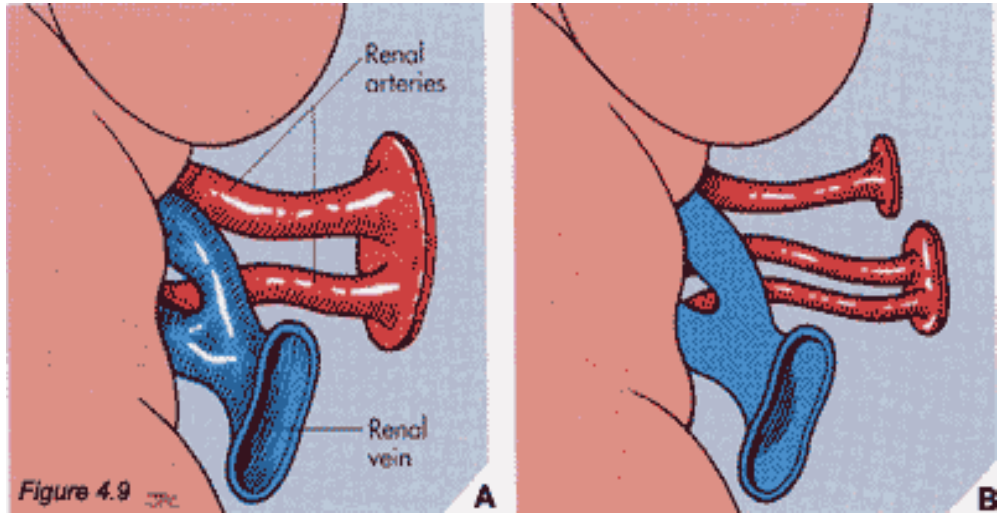


Figure 4.9

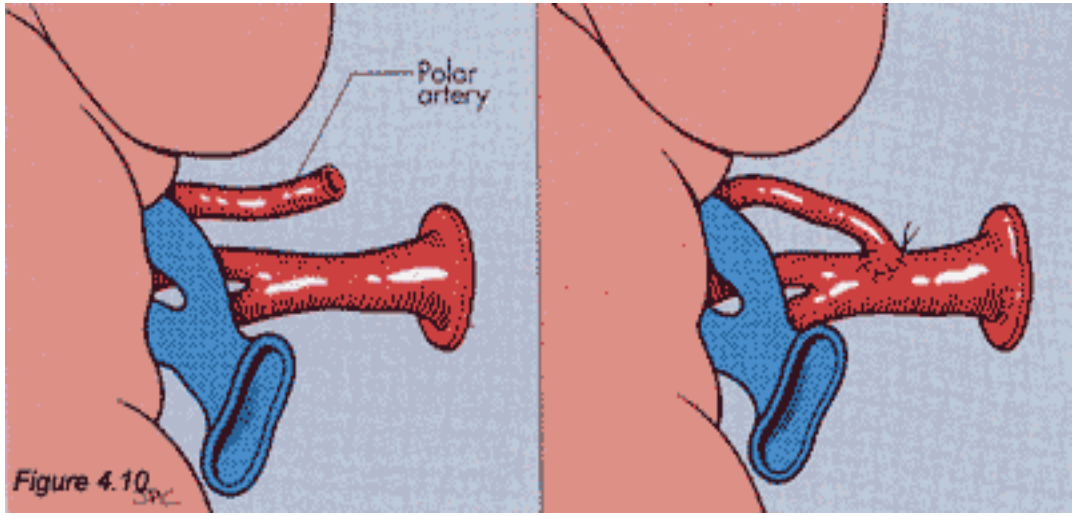
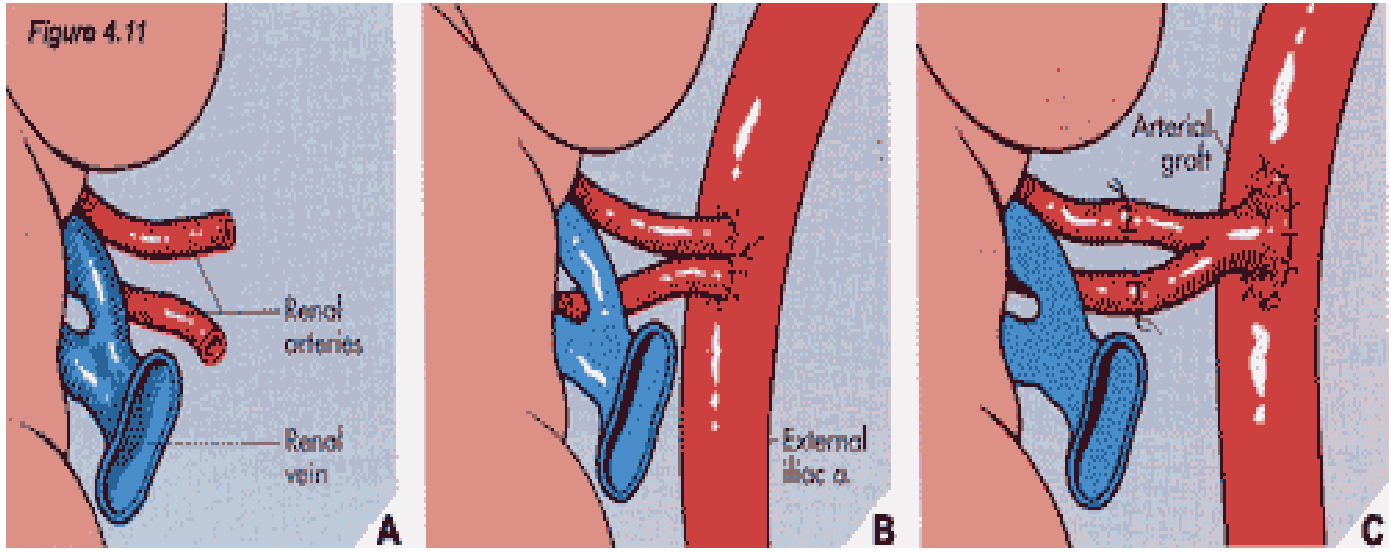


Figure 4.10

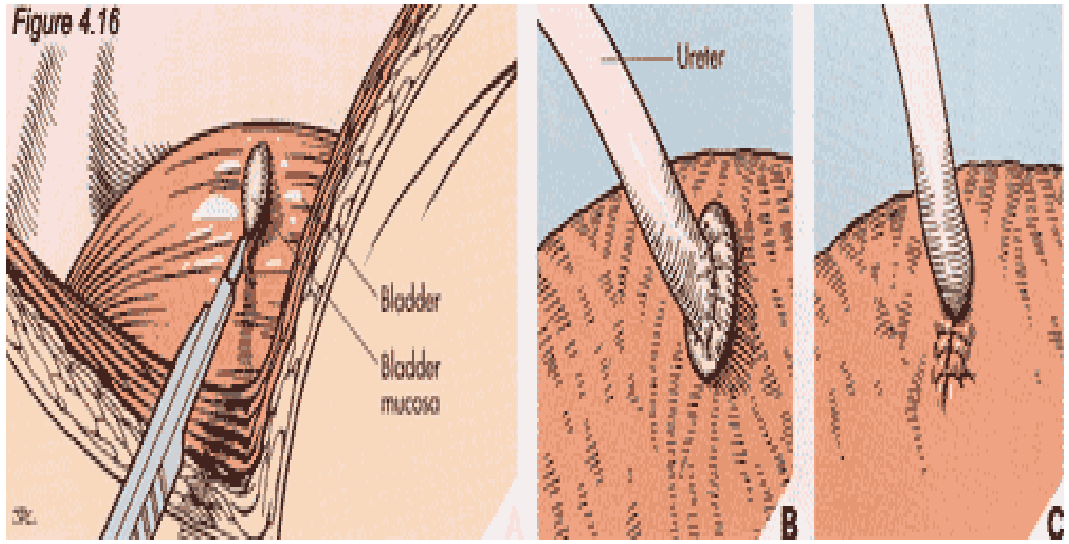
Arterial anastomosis

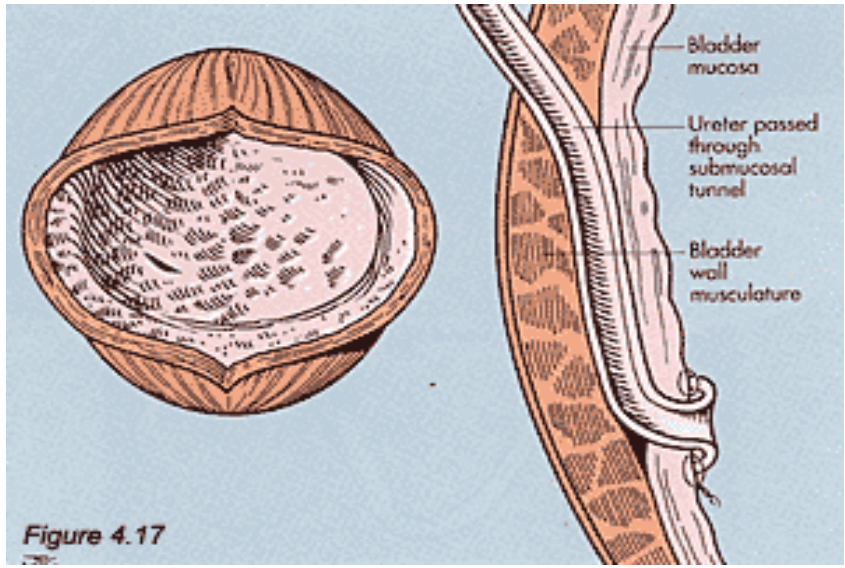
- Two transected arteries:
  - implanted separately or partially anastomosed to form a single vessel
  - lengthened by an arterial graft from the same donor
  - The latter solution also may be effective when the donor aortic cuff is atherosclerotic and the orifice of the renal artery is narrowed.



Ureteral Implantation

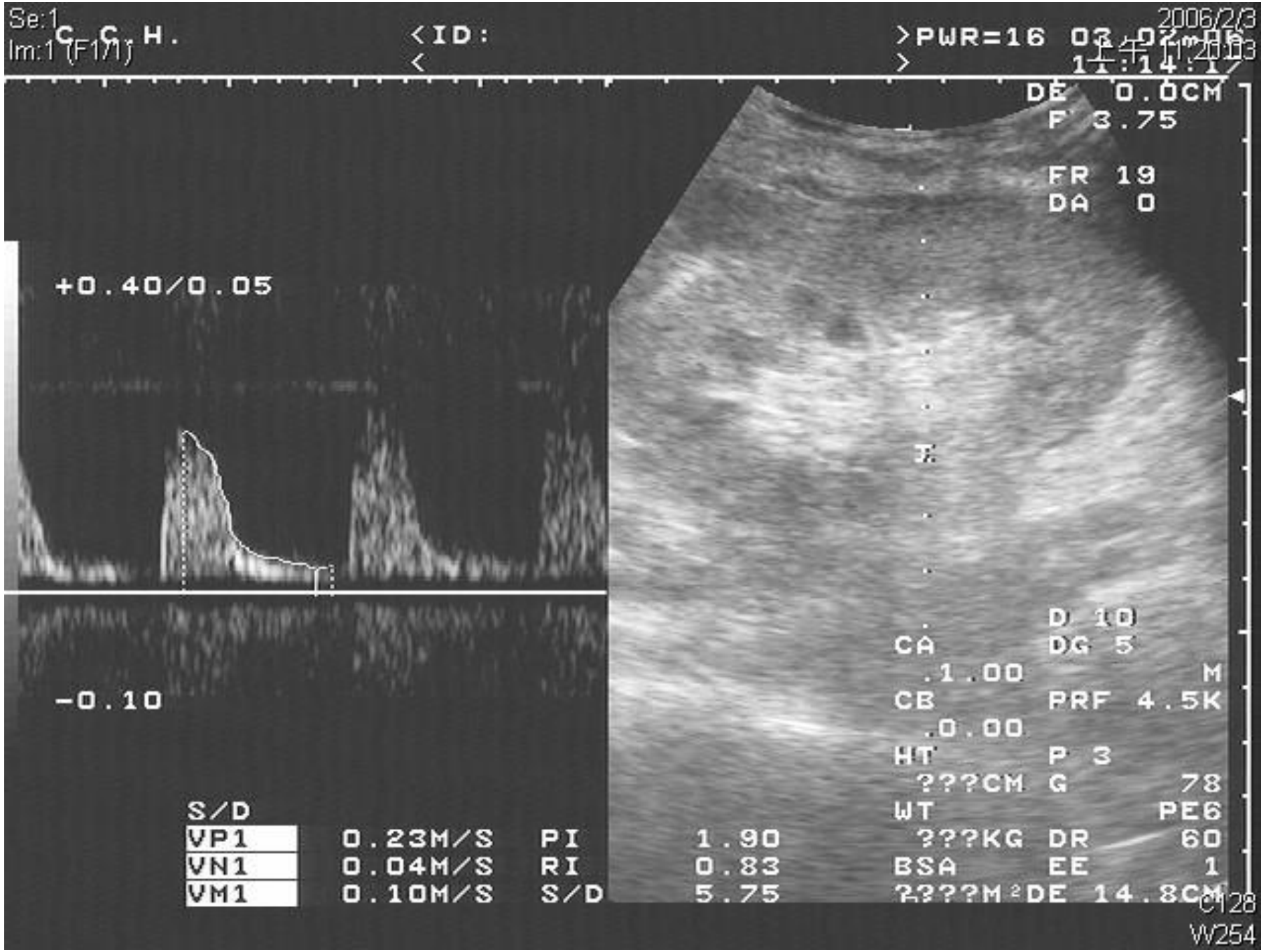
- The most problematic and least standardized procedure
- Dozens of variations exist
- Extravesical ureteroneocystostomy placed at the dome of the bladder.
- Bladder mucosa exposed through a 2.5- to 3-cm incision in the muscle
- full-thickness speculated ureter is sutured to the trigone, and a nippled ureteral anastomosis is fashioned from inside the bladder





Surgical Related Issues

- Recipient selection
- Donor pool
- Operation procedure
- **Immediate post-op care**
- Surgical complications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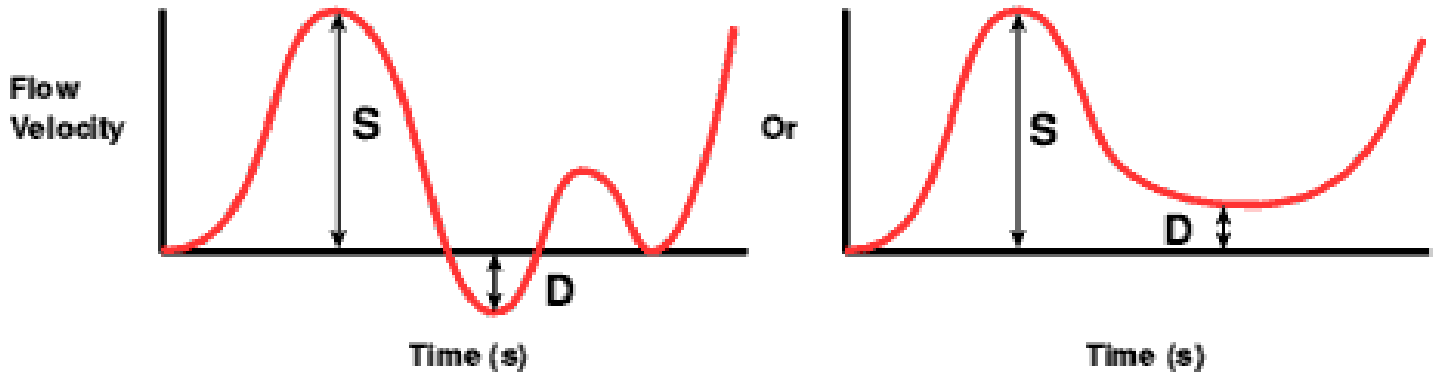
HT
P 3
???CM
G 78
WT
PE6
???KG
DR 60
BSA
EE 1
???M²
DE 14.8CM
S/D
VP1 0.23M/S PI 1.90
VN1 0.04M/S RI 0.83
VM1 0.10M/S S/D 5.75
C128
W254

Case courtesy of Brendan Cullinane, Radiopaedia.org, rID: 14760

Resistive Index

$$\text{Resistive Index (RI)} = \frac{\text{Peak Systolic Velocity} - \text{Lowest Diastolic Velocity}}{\text{Peak Systolic Velocity}}$$

$$\text{(RI)} = \frac{S - D}{S}$$



The normal range is 0.50-0.70. Elevated values are associated with poorer prognosis in various renal disorders and renal transplant.

Resistive Index

Elevated

- Acute Tubular Necrosis
- Acute or chronic rejection
- Renal vein thrombosis
- Drug toxicity
- Ureteral obstruction
- Perirenal fluid accumulation : compression

Decreased

- Renal artery stenosis

Acute Tubular Necrosis

- 20-60% of cadaveric renal grafts
- the most frequent complication in the first 48 hours
- reversible ischemic damage to the renal tubular cells prior to engraftment.
- Risk factors include:
  - Cadaveric graft
  - Hypotension in the donor prior to implantation (aggravated by the use of diuretics or vasoconstrictors to maintain urine output or blood pressure)
  - Long warm (over 30 minutes) and cold (over 24 hours) ischemic times.

Acute Tubular Necrosis

- Delay graft dysfunction
- Reversible
- Supportive therapy.
- Short-term dialysis may be required in severe cases.
- Sonographic features : variable
- Duration of graft survival : reduced

Rejection: Hyperacute Rejection

- In **MINUTES**
- Antibody to the donor
- Results in rapid destruction of the allograft on the table.
- Pre-transplantation cross-matching.
- The only option :removal of the allograft.

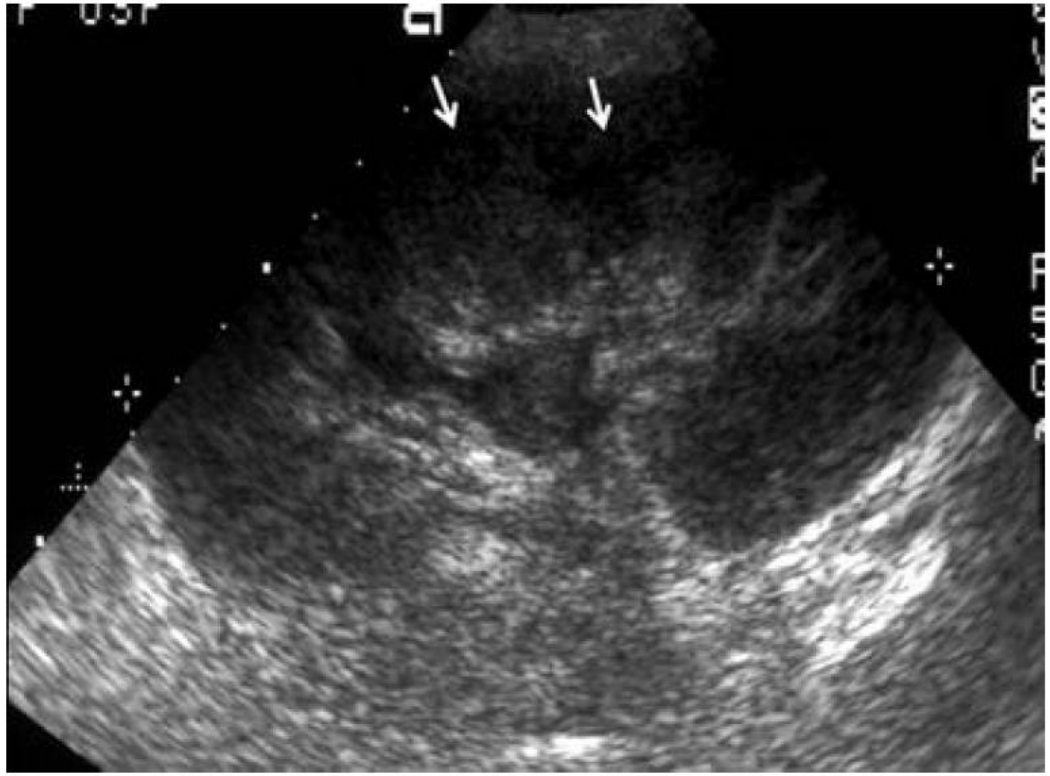
Rejection : Acute Rejection

- 7-21days
- Diagnosis:
  - Cr : ⬆
  - Urine output ⬇
  - Fever : sometimes
  - Renal biopsies (confirm)
  - Aspiration cytology
  - Renal flow studies (radioactive isotopes)
  - Ultrasound Doppler studies

Rejection : Acute Rejection

- Mechanism : not yet known, probably cell-mediated (T-cell) immunity.
- Treatment:
  - bolus of intravenous steroid, followed by a short steroid recycle.
  - antilymphocyte preparations

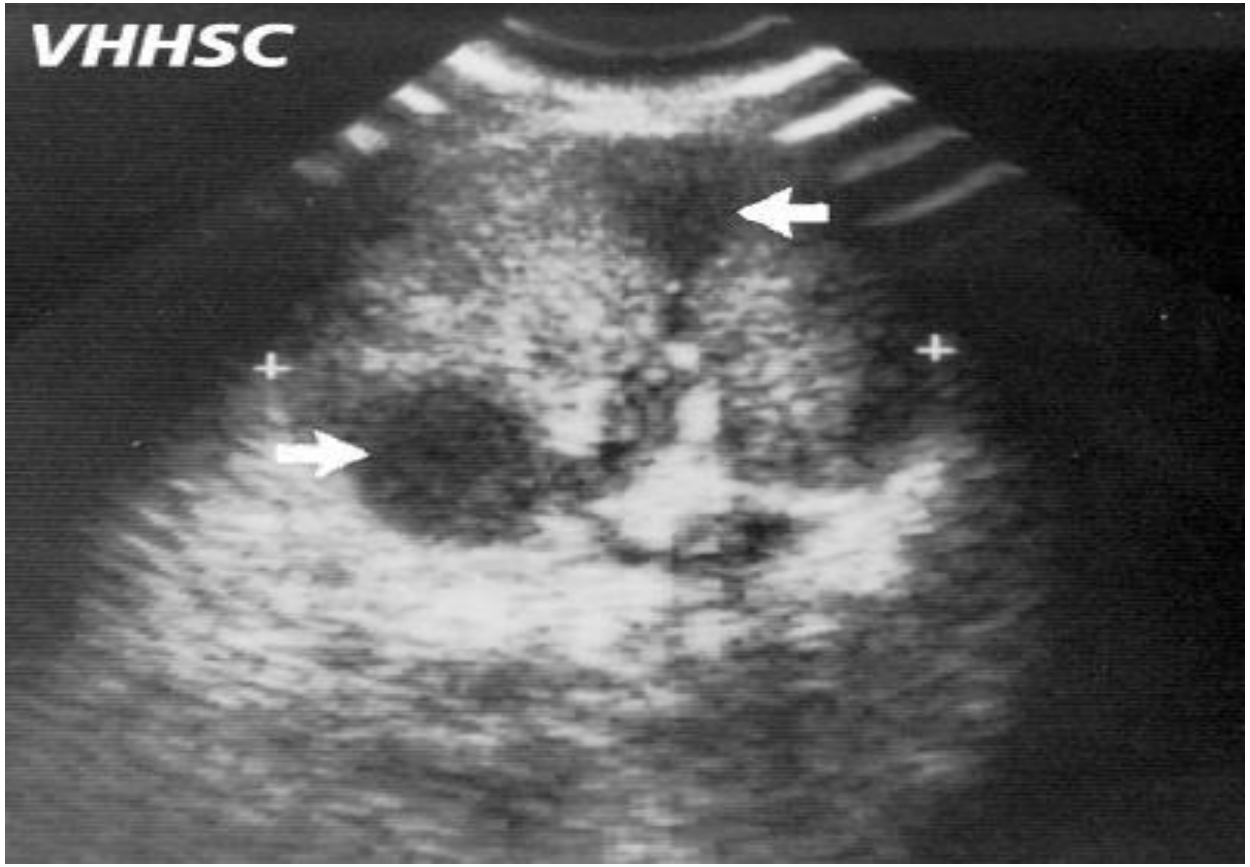
Rejection : Acute Rejection



(A)

(B)

Rejection : Acute Rejection



Rejection : Accelerated Rejection

- a variant of hyperacute rejection
- humorally mediated.
- allograft functions poorly and produces little urine, if any.
- occur after an initial period (12 to 24 hours) of good diuresis.
- Dialysis generally becomes necessary.
- Hard to distinguish from ATN (a renal flow scan may show good flow in the ATN.)

Rejection : Chronic Rejection

- poorly understood phenomenon
- late in the post-transplantation period, generally months to years after the operation.
- humoral factors may be involved.
- No therapy is satisfactory, and eventually the patient will require dialysis or re-transplantation as the graft fails

Surgical Related Issues

- Recipient selection
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- Immediate post-op care
- **Surgical complications**

Surgical Complications

- General
- Arterial
- Venous
- Ureteral

Surgical Complications

- General
  - Wound infection : antibiotics ; drainage
  - Seroma : drainage
  - Incision hernia : repair
  - Hematoma
  - Lymphocele: drainage (percutaneous or operative)
- Arterial
- Venous
- Ureteral

Hematoma

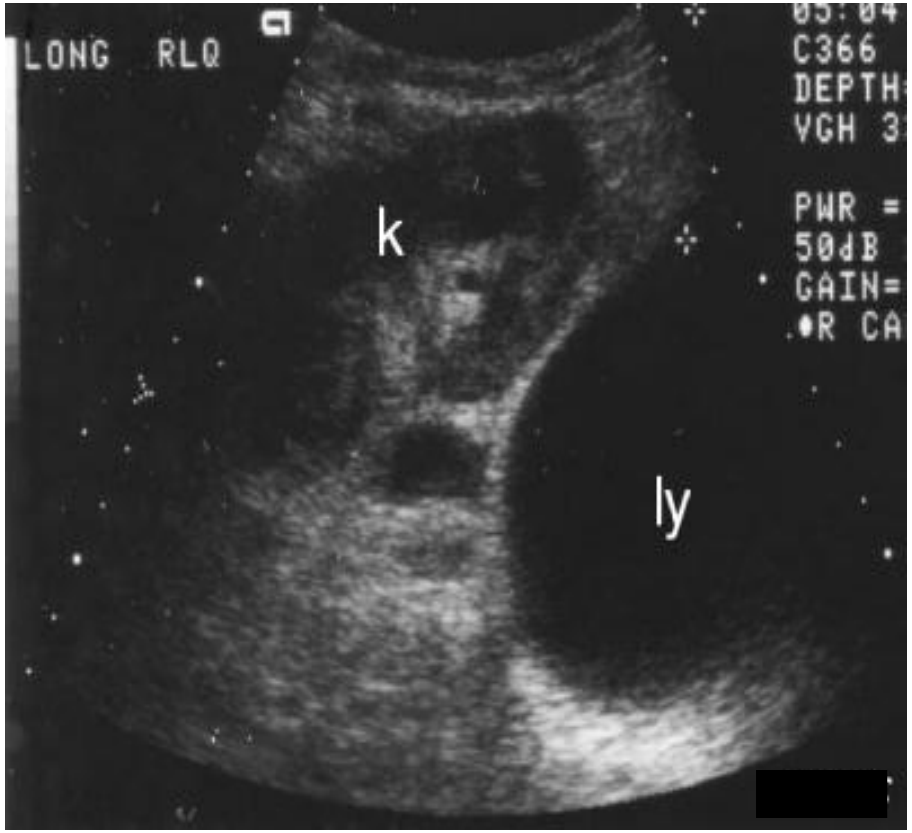

4.0 MHz
ABDOMEN
63dB -/+1/3
GAIN=-13dB

(A)


RTX D LG SUP
C3e* 1
3.5MHz 160
ABDOME
0
PWR = 0
58dB 3/5
GAIN= 14
•R CALIP
x DISTANCE = 88.8mm

(B)

Lymphocele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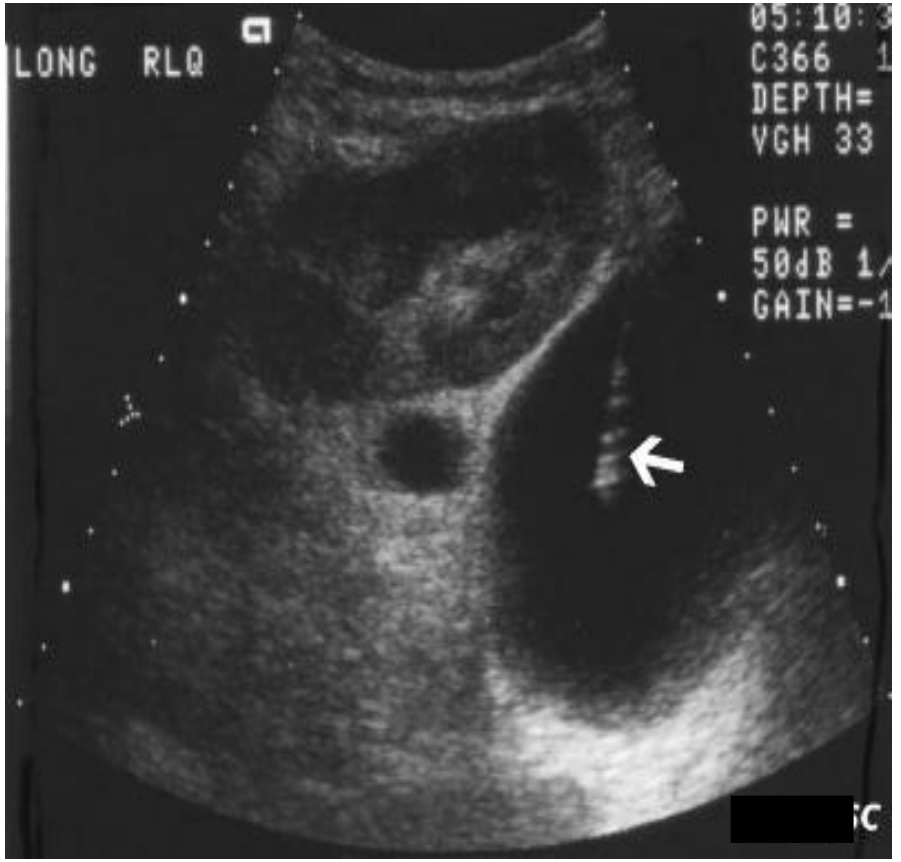
LONG RLQ
C366
DEPTH=
VGH 33
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Lymphocele


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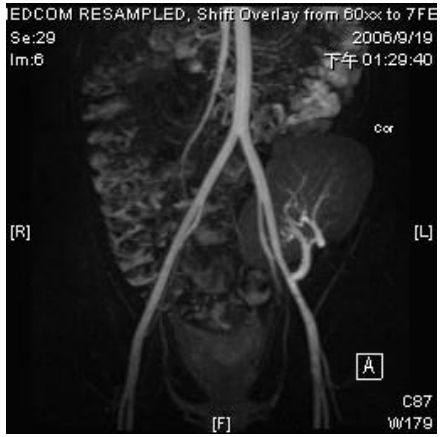
C40
W400

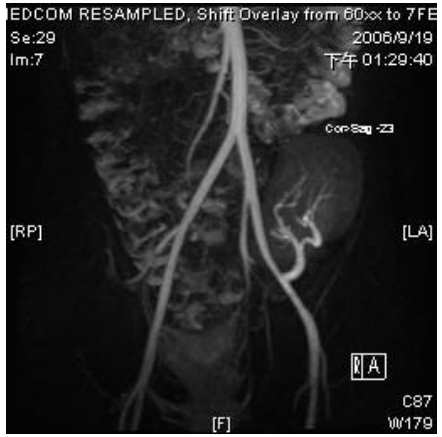
Surgical Complications

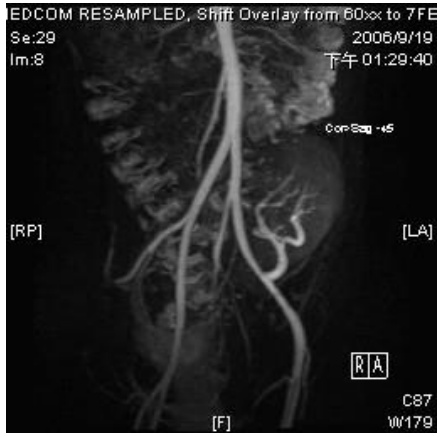
- General
- **Arterial**
- Venous
- Ureteral

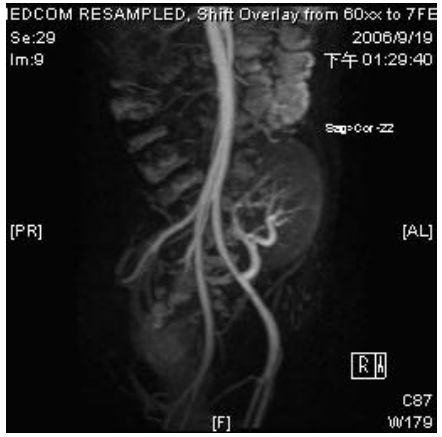
- Thrombosis :
  - thrombectomy
  - nephrectomy
- Stenosis :
  - radiological dilatation
  - operative repair

Post-op angiography





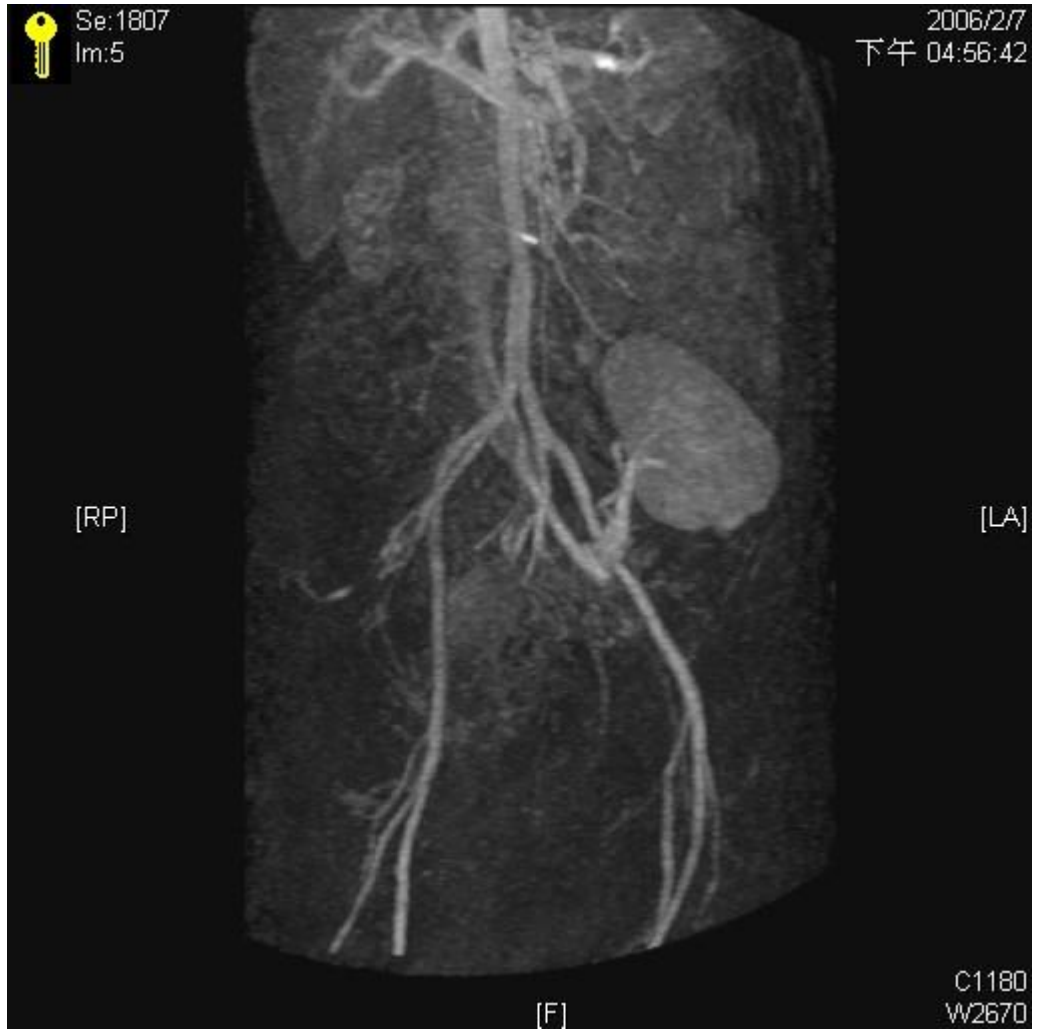




Surgical Complications

- General
- Arterial
- **Venous**
- Ureteral

- Thrombosis
  - Partial : heparin
  - Complete : nephrectomy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Surgical Complications

- General
- Arterial
- Venous
- **Ureteral**

- Necrosis , urine leakage :
  - Reimplantation
  - Native nephrectomy + ureteroureterostomy
- Chronic stenosis
  - Radiological dilatation
  - Double J ureteral stenting
  - Ureteroplasty : buccal mucosa


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Investigation of Graft Failure

	Immediately (<1 wk)	Early (1~4 wks)	Late (>4 wks)
Parenchymal	Acute Tubular Necrosis Rejection · *Hyperacute* · *Accelerated Acute* · *Acute*	Acute Rejection	Acute Rejection Chronic Rejection Cyclosporine Toxicity Disease Recurrence Infection
Vascular	Renal Vein Thrombosis Renal Artery Thrombosis	Renal Vein Thrombosis	Renal Artery Stenosis
Urologic	Ureteral Oedema	Urinary Fistulae Urinoma	Ureteral Strictures
Fluid Collections	Haematoma Abscess	Urinoma	Ureteral Strictures
Iatrogenic	Post Biopsy Haemorrhage Renal AV Fistula Pseudoaneurysm		

Complications

Medical complications

- Drug toxicity
- Infections:
  - Fugal : oral Candida, systemic Candida
  - Viral :Herpes, EBV, CMV (most common)
  - Protozoal: pneumocystis carinii
  - Bacterial: legionella, tuberculosis
- Malignancy:
  - skin cancer
  - lymphoproliferative disease

TO BE CONQUERED

- Robot-assisted kidney transplant

Thanks for Your Listening