

# Robot-Assisted Kidney Transplantation

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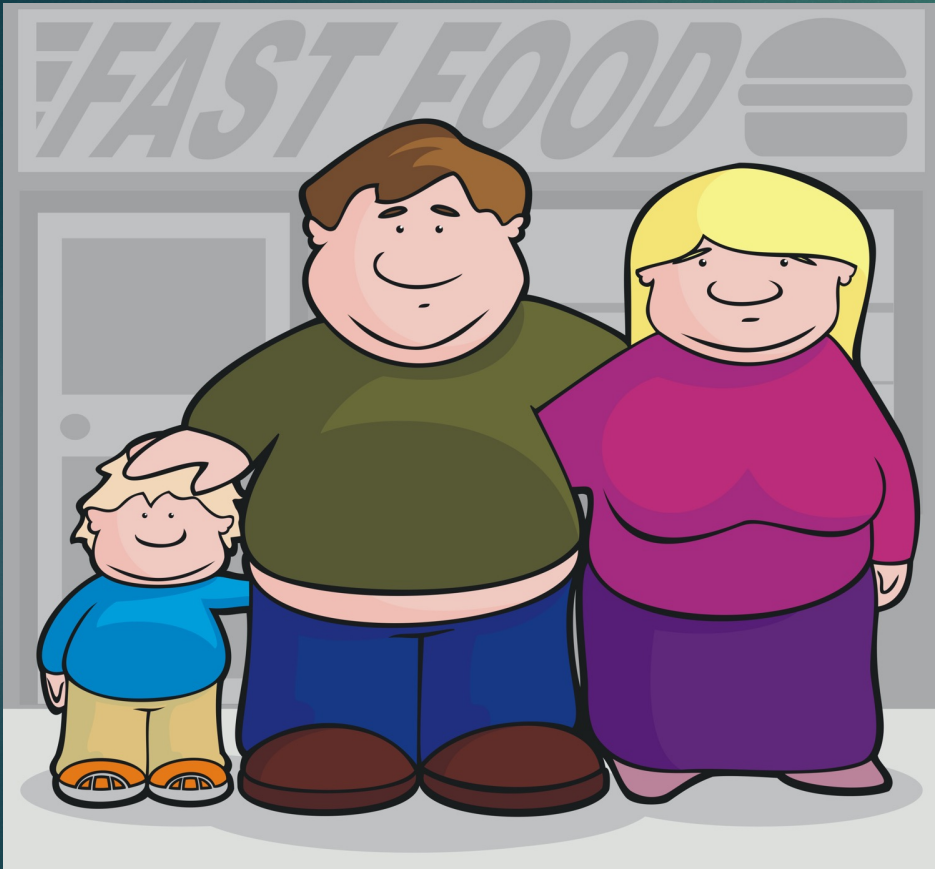


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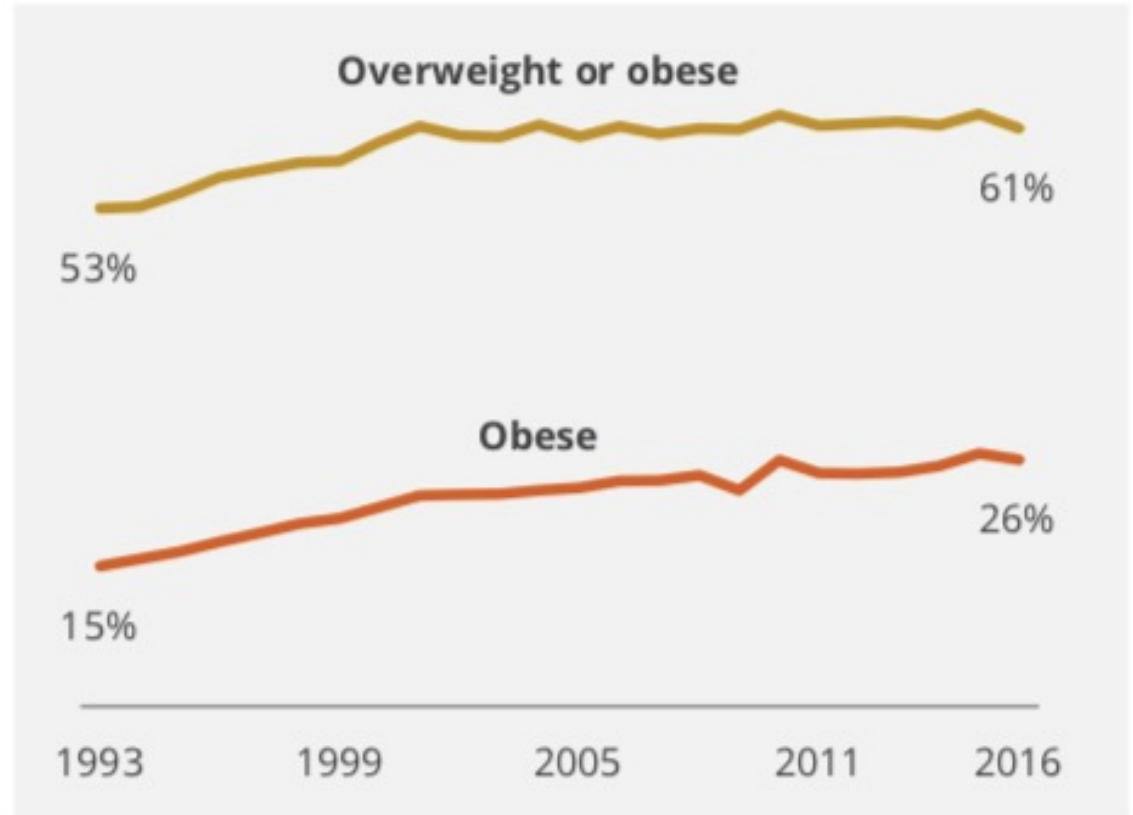


- Open kidney transplantation:
  - Is successful – 97% one-year graft survival
  - Has been performed the same way for > 60 years
- Our population is changing.....  
.....and surgery is changing

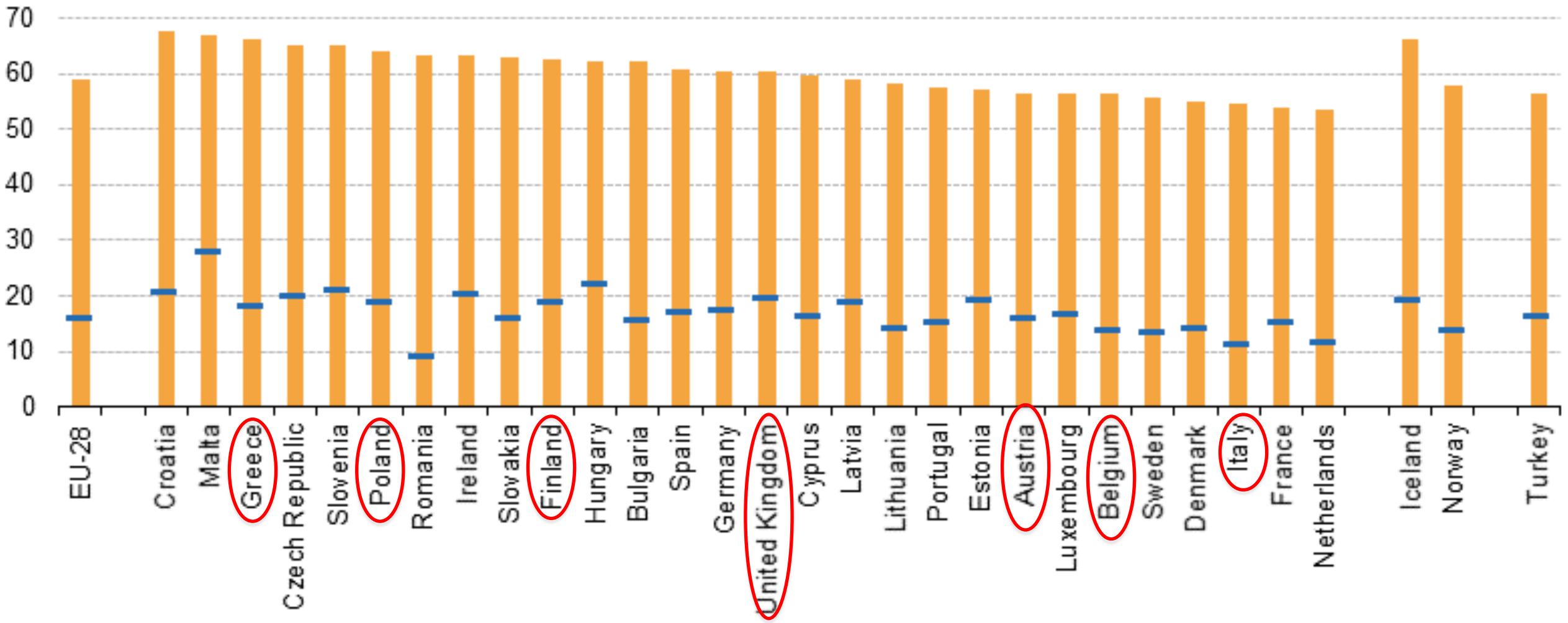


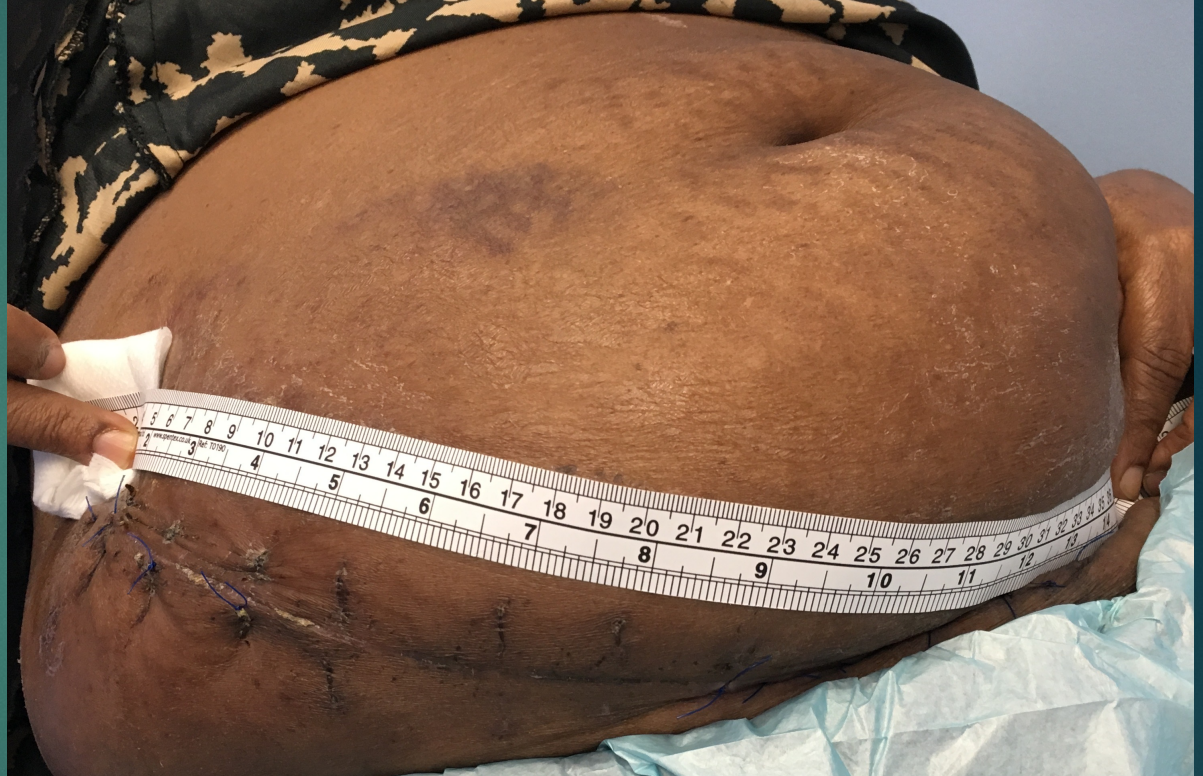
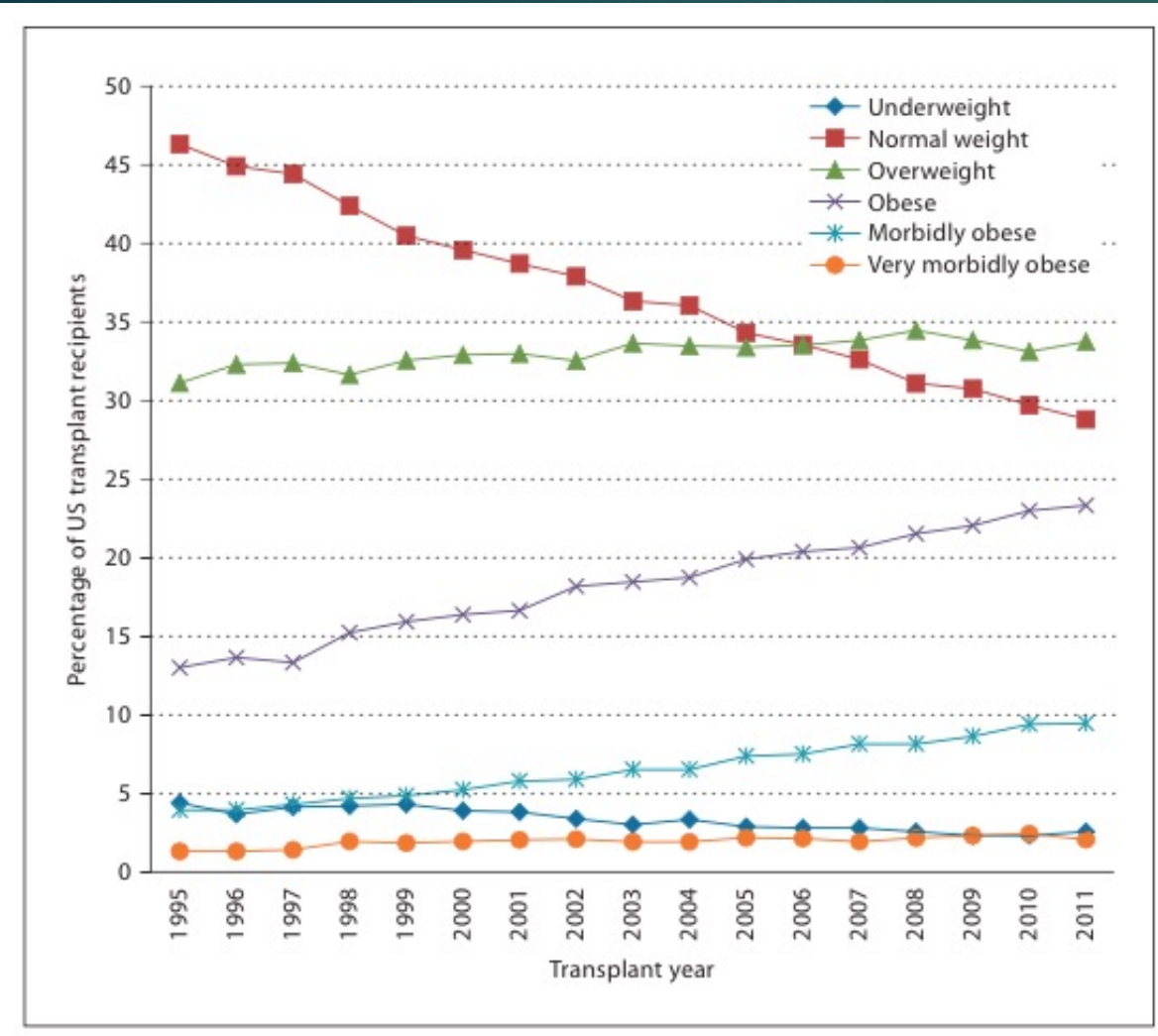


Obesity levels have increased from 15% to 26% since 1993.

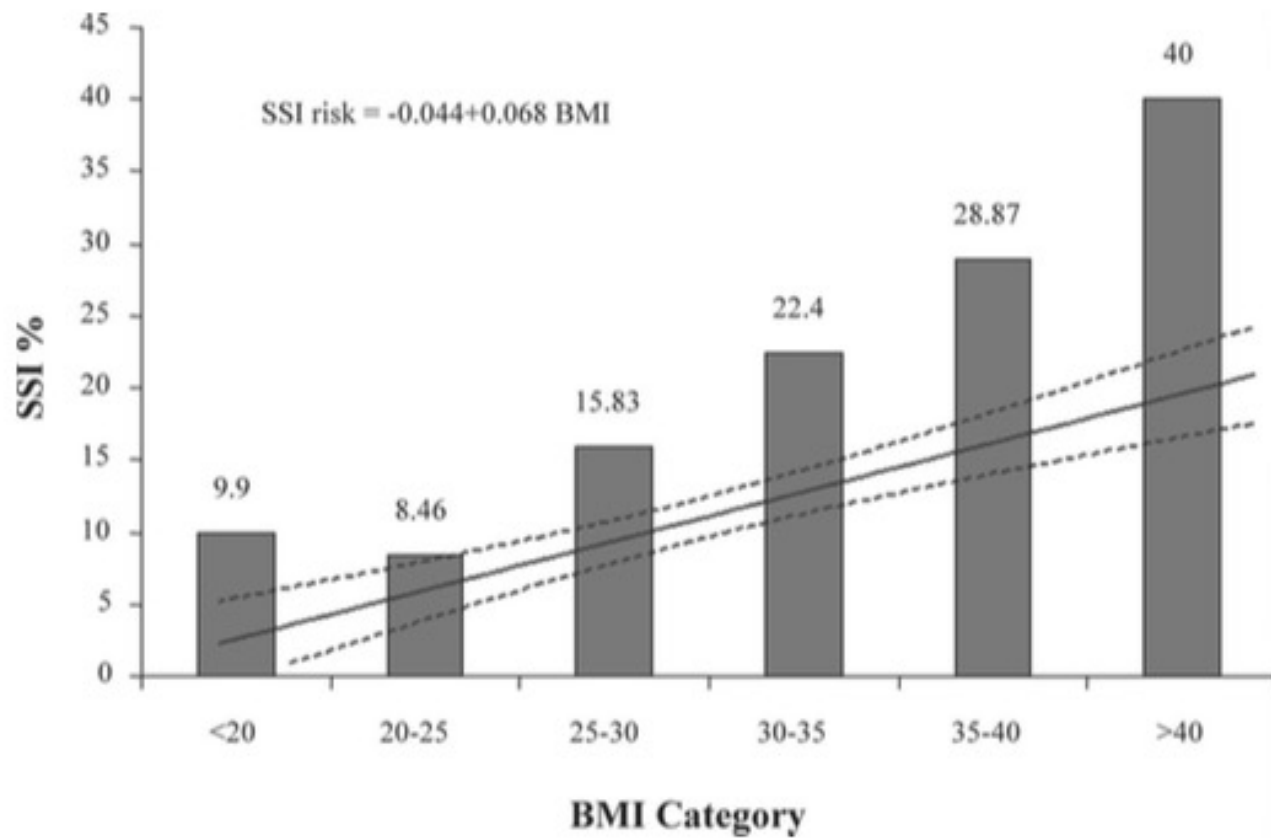


# Proportion of overweight and of obese men, 2014



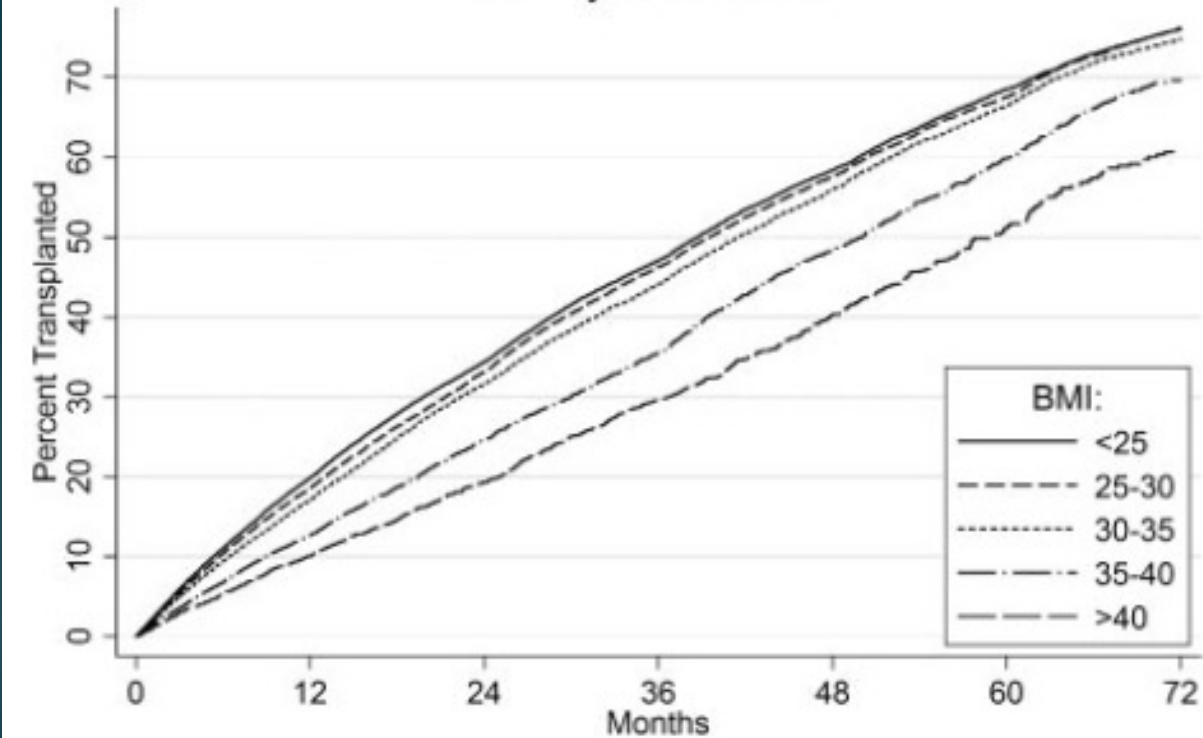


*Am J Nephrol* 2012;36:575–586



(*Ann Surg* 2009;250: 1014–1020)

### Time to Transplantation Kidney Candidates



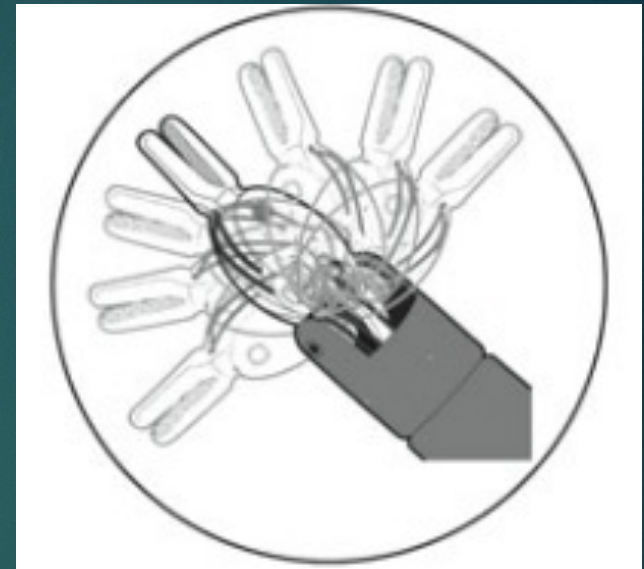
*J Am Soc Nephrol* 19: 349–355, 2008.

- Obesity is a barrier to listing for many patients
- Access to bariatric services for many is poor

# Robotic Transplantation

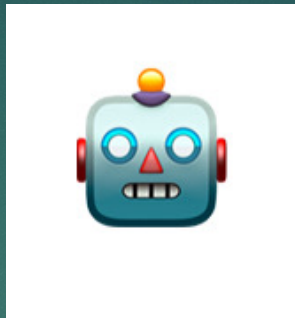
If proven to be safe and effective, has the potential:

- 1.To improve access to transplantation for patients currently excluded due to their weight
- 2.To reduce complications and improve outcomes in obese patients undergoing transplantation

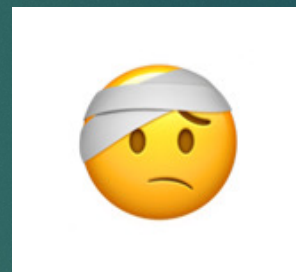


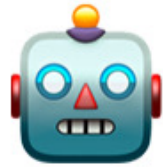






- ▶ Simulation
- ▶ Remote operating
- ▶ Training platform
- ▶ Imaging overlay
- ▶ Artificial intelligence

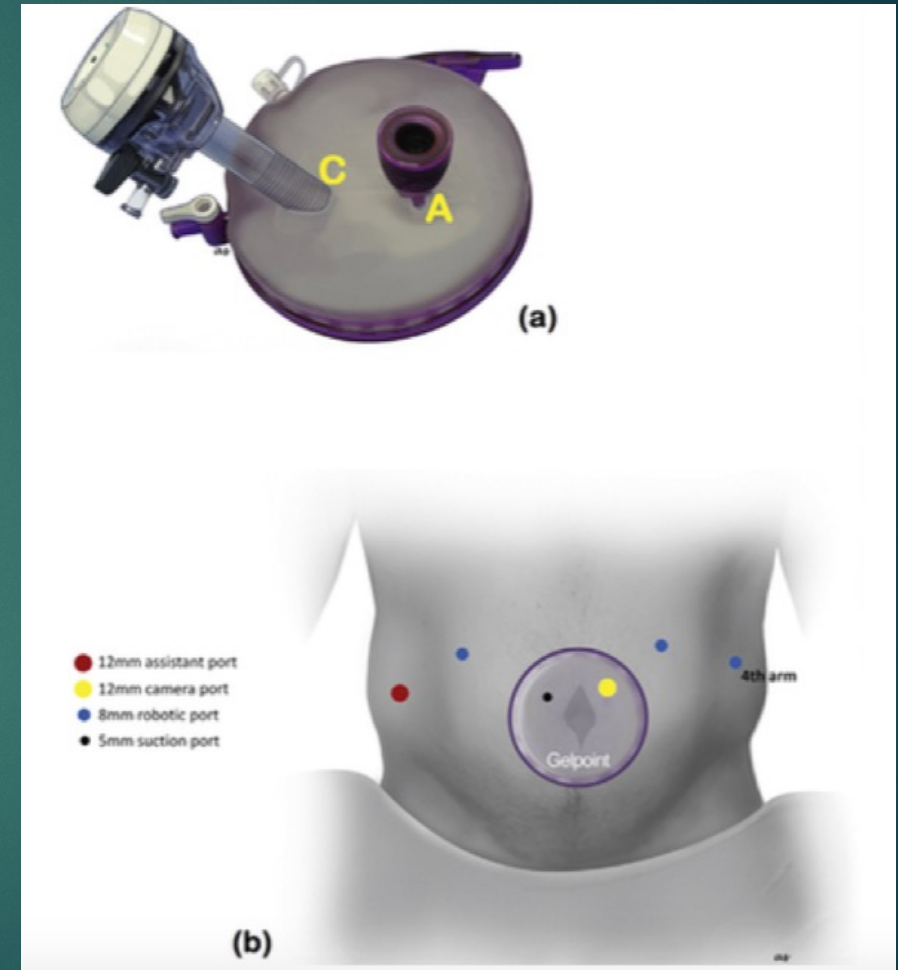




Artificial intelligence



# Operative technique





# What is the evidence for RAKT?



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Original Clinical Science



# Minimally Invasive Kidney Transplantation: Perioperative Considerations and Key 6-Month Outcomes

Akshay Sood,<sup>1</sup> Prasun Ghosh,<sup>2</sup> Wooju Jeong,<sup>1</sup> Sangeeta Khanna,<sup>3</sup> Jyotirmoy Das,<sup>3</sup> Mahendra Bhandari,<sup>1</sup>  
Vijay Kher,<sup>2</sup> Rajesh Ahlawat,<sup>2</sup> and Mani Menon<sup>1</sup>

Transplantation 2015

Case series of 54 RKT patients, 6 month follow-up



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## Minimally Invasive Kidney Transplantation: Perioperative Considerations and Key 6-Month Outcomes

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Primary Function	100%	
Conversion to Open	0	
Graft Survival	100%	
Patient Survival	96%	2 deaths from cardiological event
Acute Rejection	13%	Biopsy performed in 20%

# Key Learning Points

- Trendelenburg position → head & neck oedema
  - Careful with intra-operative fluids
- Pneumoperitoneum → 2 “hits” (donor and recipient surgery)
  - Reduce pneumo after reperfusion
- Pneumo + Trendelenburg = false elevation of CVP
  - Measure baseline CVP at start of op
  - On-table Doppler or other
- Transperitoneal approach → risk of torsion & biopsy access
  - Routine extraperitonealisation of graft



# Minimally Invasive Robotic Kidney Transplantation for Obese Patients Previously Denied Access to Transplantation

J. Oberholzer, MD<sup>1</sup>, P. Giulianotti, MD<sup>2</sup>, K.K. Danielson, PhD<sup>1,5</sup>, M. Spaggiari, MD<sup>1</sup>, L. Bejarano Pineda, MD<sup>1</sup>, F. Bianco, MD<sup>2</sup>, I. Tzvetanov, MD<sup>1</sup>, S. Ayloo, MD<sup>2</sup>, H. Jeon, MD<sup>1</sup>, R. Garcia-Roca, MD<sup>1</sup>, J. Thielke, PharmD<sup>3</sup>, I. Tang, MD<sup>4</sup>, S. Akkina, MD<sup>4</sup>, B. Becker, MD<sup>4</sup>, K. Kinzer, BS<sup>1</sup>, A. Patel, MBA<sup>1</sup>, and E. Benedetti, MD<sup>1</sup>

<sup>1</sup>Division of Transplantation, University of Illinois Hospital & Health Sciences System, University of Illinois at Chicago

Am J Transplant, 2013

Comparative study of 56 obese patients (28 RKT vs 28 OKT)



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	<b>RAKT</b>	<b>OKT</b>	<b>p value</b>
Mean BMI	42.6	38.1	<b>0.02</b>
Acute Rejection	21.4%	17.8%	NS
SSI	0%	29%	<b>0.004</b>
Creatinine at discharge	176 umol/l	123 umol/l	<b>0.04</b>



**Minimally Invasive Robotic Kidney Transplantation for Obese Patients Previously Denied Access to Transplantation**

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Creatinine at discharge	176 umol/l	123 umol/l	<b>0.04</b>
Creatinine at 6 months	132 umol/l	141umol/l	NS
Patient Survival	100%	100%	NS
Graft Survival	100%	100%	NS

# Robot-assisted Kidney Transplantation: The European Experience

*Alberto Breda<sup>a,\*</sup>, Angelo Territo<sup>a</sup>, Luis Gausa<sup>a</sup>, Volkan Tuğcu<sup>b</sup>, Antonio Alcaraz<sup>c</sup>,  
Mireia Musquera<sup>c</sup>, Karel Decaestecker<sup>d</sup>, Liesbeth Desender<sup>e</sup>, Michael Stockle<sup>f</sup>, Martin Janssen<sup>f</sup>,  
Paolo Fornara<sup>g</sup>, Nasreldin Mohammed<sup>g</sup>, Giampaolo Siena<sup>h</sup>, Sergio Serni<sup>h</sup>, Luis Guirado<sup>i</sup>,  
Carma Facundo<sup>i</sup>, Nicolas Doumerc<sup>j</sup>*

European Urology 2017

Multicenter registry of 120 RAKT patients



RCSI  
Beaumont  
Hospital



## Robot-assisted Kidney Transplantation: The European Experience





Alberto Breda<sup>a,\*</sup>, Angelo Territo<sup>a</sup>, Luis Gausa<sup>a</sup>, Volkan Tuğcu<sup>b</sup>, Antonio Alcaraz<sup>c</sup>,  
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Primary Function	96%	5 cases of DGF
Graft Survival	97%	3 required graft nephrectomy due to massive arterial thrombosis
Bleeding requiring transfusion	3%	
Conversion to Open	2%	2 converted due to low perfusion at Doppler evaluation



**Original Article**

# **Robot-assisted kidney transplantation: update from the European Robotic Urology Section (ERUS) series**

Mireia Musquera<sup>1</sup> , Lluís Peri<sup>1</sup>, Tarek Ajami<sup>1</sup>, Riccardo Campi<sup>2</sup> , Volkan Tugcu<sup>3</sup> , Karel Decaestecker<sup>4</sup>, Michael Stockle<sup>5</sup>, Paolo Fornara<sup>6</sup>, Nicolas Doumerc<sup>7</sup>, Frances Vignes<sup>8</sup>, Ravi Barod<sup>9</sup>, Liesbeth Desender<sup>11</sup>, Angelo Territo<sup>10</sup> , Sergio Serni<sup>2</sup>, Graziano Vignolini<sup>2</sup>, Selçuk Sahin<sup>3</sup>, Philippe Zeuschner<sup>5</sup>, Neal Banga<sup>9</sup>, Alberto Breda<sup>10</sup> and Antonio Alcaraz<sup>1</sup>

- ▶ BJU International 2020
- ▶ Update on European multicenter registry
- ▶ Now 291 RAKT patients

# Comparison of 2017 & 2020 Registry Data

	2017 (120 patients)	2020 (291 patients)
Primary Function	96%	98%
Graft Survival	97%	98%
Bleeding requiring transfusion	3%	2%
Conversion to Open	2%	2.7%

19<sup>th</sup> Congress of the European Society for Organ Transplantation

**ESOT 2019 CONGRESS**

INSPIRING MINDS, DRIVING PROGRESS

the international transplant Congress

COPENHAGEN

SEPTEMBER 15 - 18, 2019  
Copenhagen, Denmark



Is robot-assisted kidney transplant (RAKT) safe, and does it produce equivalent graft outcomes to open kidney transplant (OKT)?

# Inclusion criteria

- Meets institutional criteria for OKT
- 1<sup>st</sup> transplant from living donor
- ABO- and HLA- compatible
- No previous major abdominal surgery
- Left kidney, RIF implant
- Single arterial and venous anastomoses



# Outcome measures

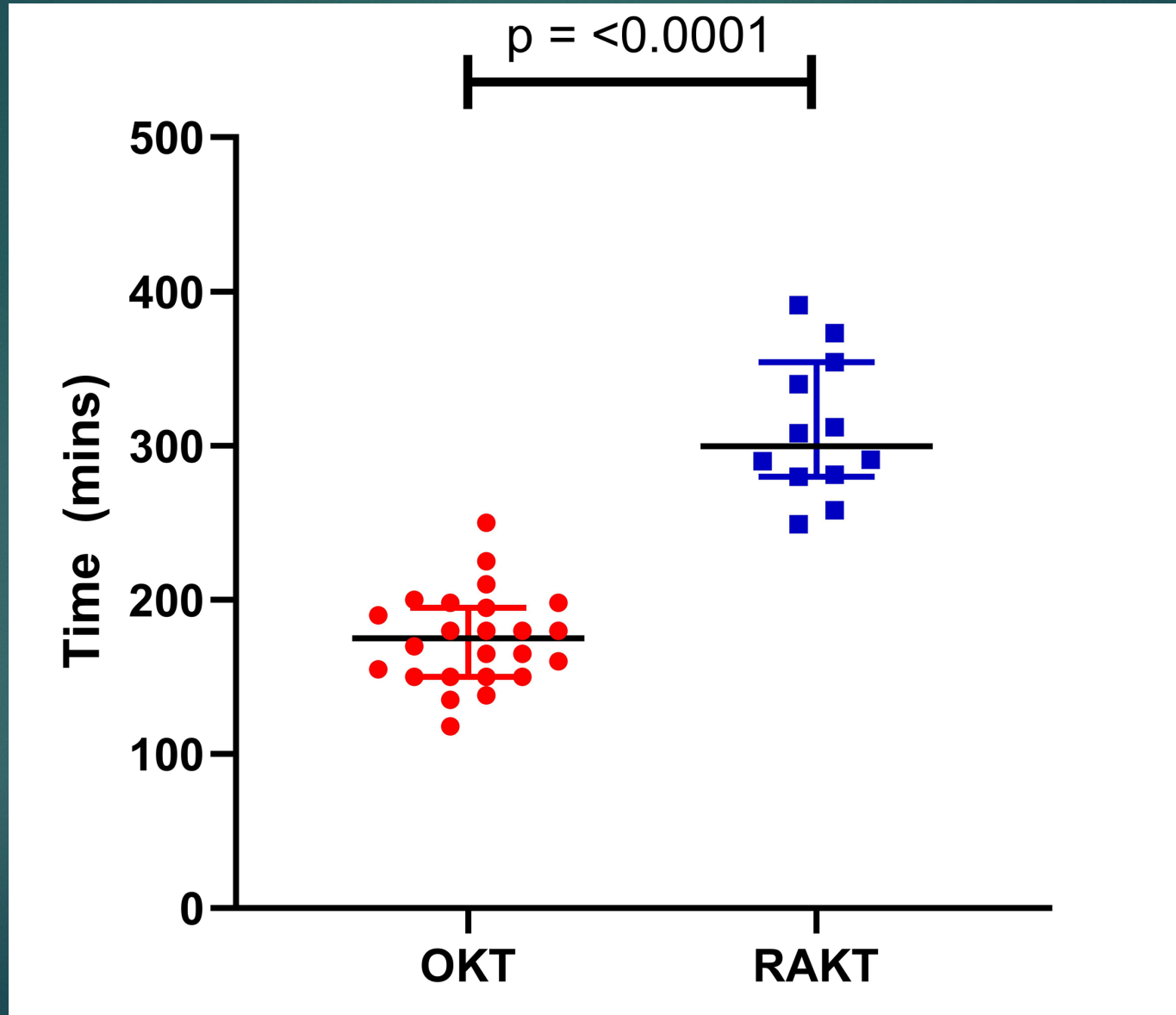
- Primary outcome:
  - eGFR (mls/min/1.73m<sup>2</sup>) at 3, 6 & 12 months
- Secondary outcomes:
  - Operative time
  - Implantation time
  - Return to theatre
  - Wound infections
  - Length of hospital stay



# Donor & recipient characteristics

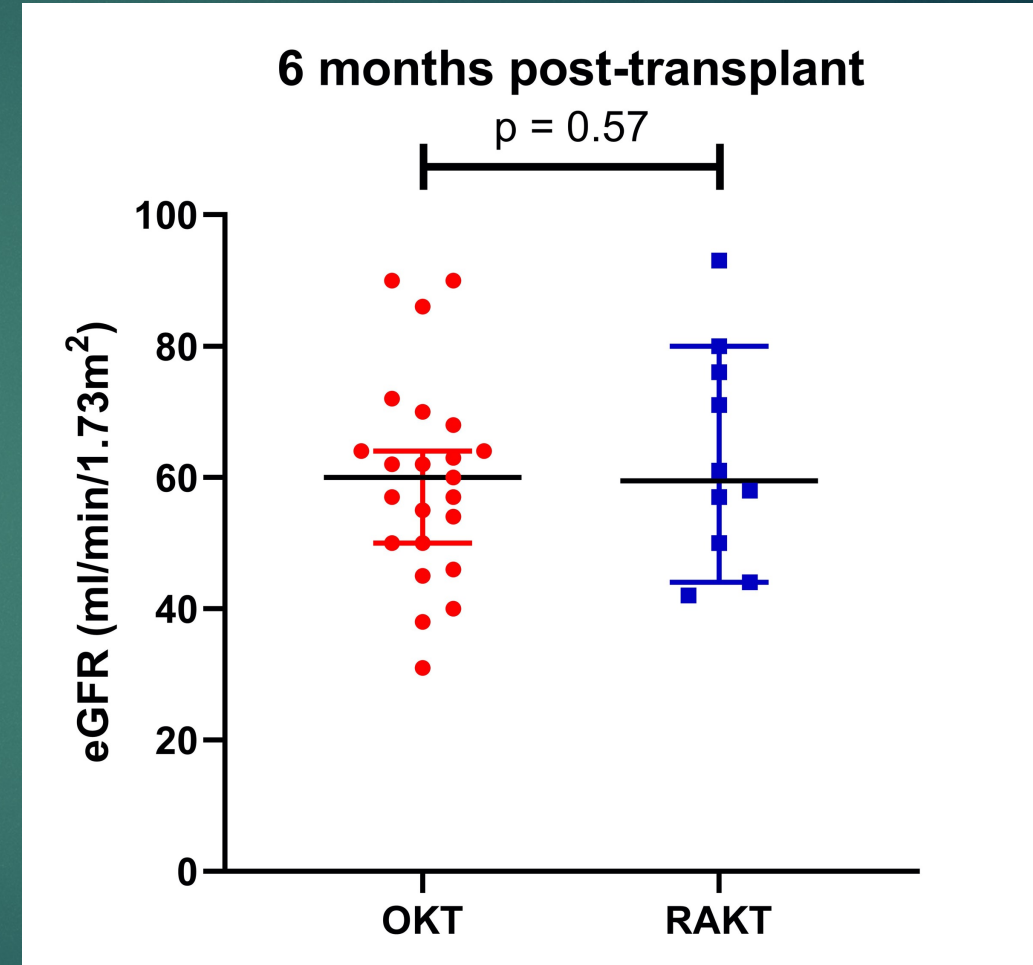
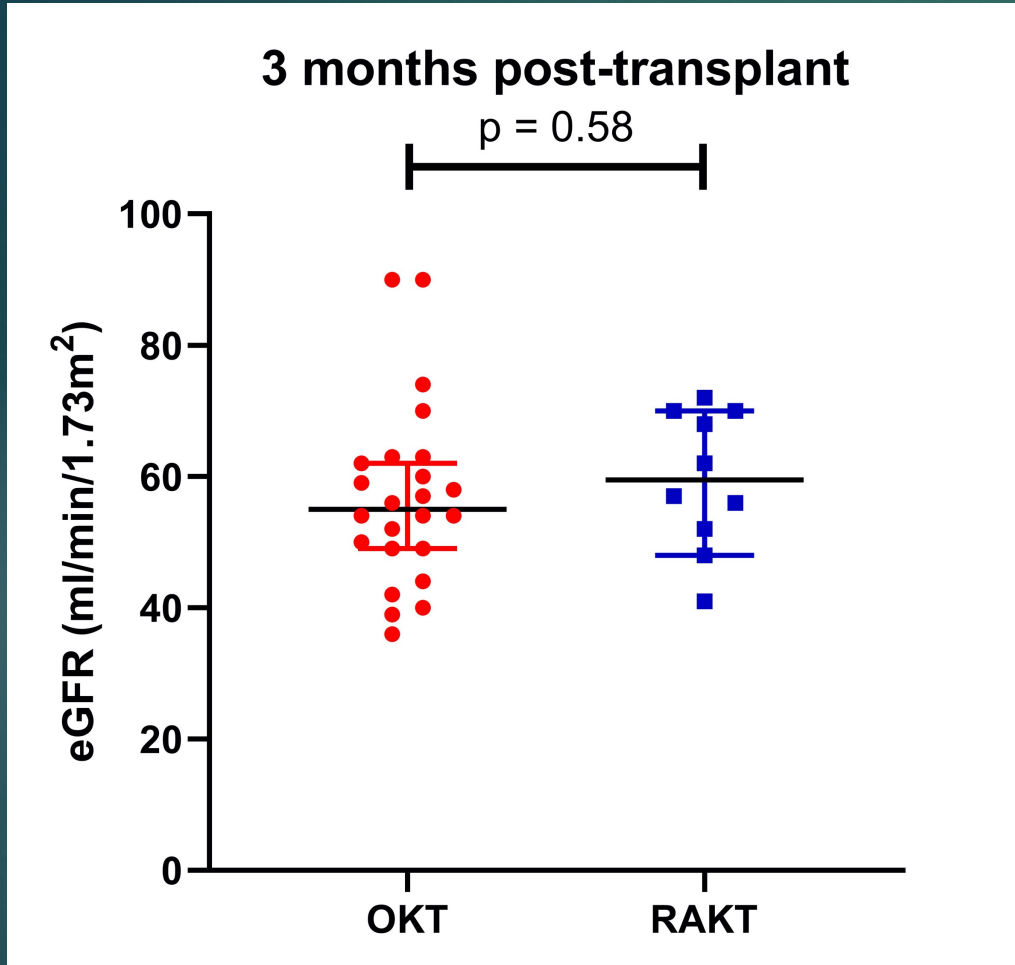
	OKT (n=24)		RAKT (n=12)		p value
	Median	Range	Median	Range	
Recipient Age (years)	47.0	18 – 68	43.5	29 – 60	0.84
Recipient BMI (kg/m <sup>2</sup> )	24.8	19.5 – 37.9	27.0	22.7 – 38.3	0.04
Donor Age (years)	48.5	24 – 66	48.5	31 – 63	0.72
Donor GFR (ml/min/1.73m <sup>2</sup> )	93.0	74 – 135	91.5	74 – 108	0.37

# Total operative time

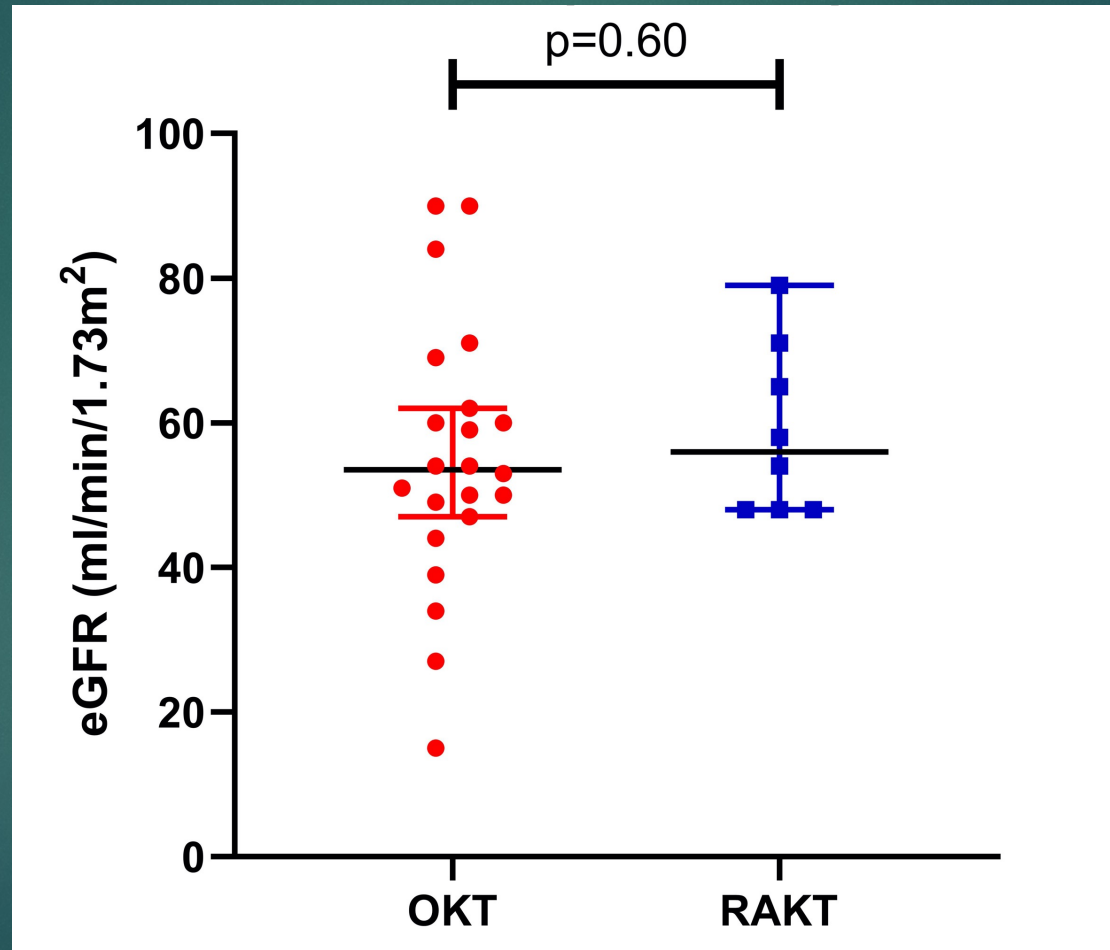




# eGFR at 3 & 6 months



# eGFR at 12 months



# Secondary outcomes

	OKT (n = 24)	RAKT (n = 12)	p value
Return to Theatre	1	1	1.00
Wound Infections	0	0	1.00
Median length of stay (days)	6.0	5.5	0.54





# Royal Free Programme 2016-20

- 20 cases
- 100% graft & patient survival
- 1/20 ureteric complication -> open re-implant
  
- Median operative time 290 mins (fastest = 249)
- Median implantation time 64 mins (fastest = 55)



# Conclusions

- RAKT is technically challenging
  - Steep learning curve
  - Longer implantation & operative times
- Initial outcomes are equivalent to OKT
  - Use of intra-corporeal ice

# How to get started.....

To set up a RAKT programme you need:

- An experienced robotic “buddy”
- A mentor in RAKT
- Hours on the simulator
- Wetlab practice
- To do other operations with the robot
- To engage with the patients and involve them!





The difficulty lies, not in the new ideas,  
but in escaping from the old ones.

*John Maynard Keynes (1883–1946)*

