

The Limits of a Robot-Assisted Approach in the Management of Renal Cell Carcinoma

Christopher Anderson



Section of
Oncology

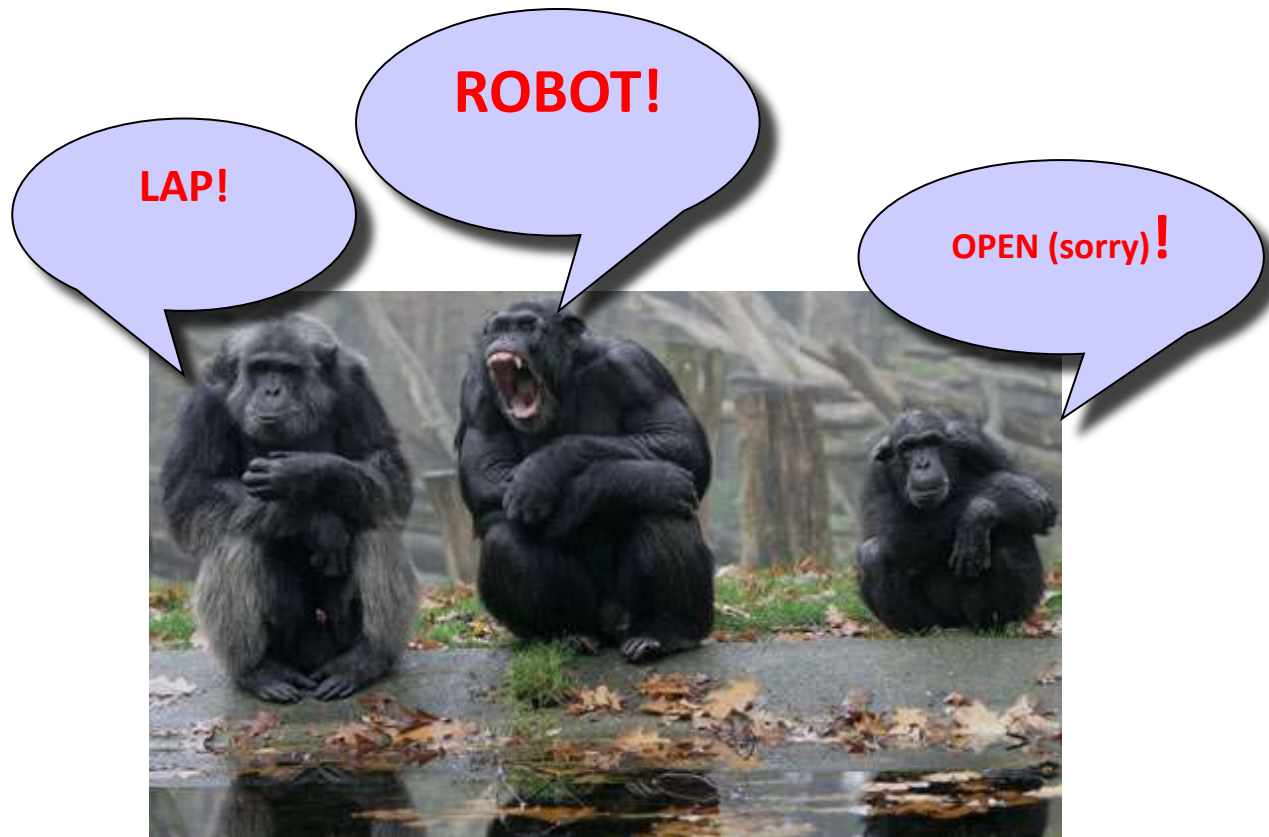


St George's Healthcare
NHS Trust



The Evidence “For” The Robotic Approach

There is NO randomised controlled trial comparing Open, Laparoscopic or Robot Assisted Partial Nephrectomy



Comparing RPN to OPN

- ❖ Multicentre matched pair analysis RPN (200) vs OPN(200)
- ❖ *Equivalent perioperative , pathological / functional outcomes for cT1*
- ❖ RPN:
 - *Less invasive*
 - *Lower risk blood loss 100 vs 150 (transfusion same)*
- ❖ OPN:
 - *Shorter WIT*
 - *higher number unclamped*
- ❖ Post op complications : RPN 14% and 21.5%
 - *major same at 4.5%*

V.Ficarra et al BJUI June 2014 Vol 113;6

Complex Tumours – RPN vs OPN

- ❖ Matched pair analysis :small numbers *Ficarra et al BJUI 2014*
 - ❖ Non matched pair analysis mod to complex using RENAL (91 RPN and 190 OPN) *Simhan et al J UROL 2012;187*
 - ❖ (LAPN and RPN) vs OPN cT1b (only 16 robot procedures) *Sprengle EUR UROL 2012;61*
 - ❖ *Overall : Favourable and comparable perioperative /functional parameters and shorter LOS*
-

Comparing RPN to LPN

- ❖ Two meta-analyses showed only minimal advantage in favour of RPN in terms of WIT
- ❖ Both include small observational studies in which LPN represented historical series and *RPN strongly influenced by learning curve*
- ❖ Two large studies (excl in above for methodological reasons) both showed significant advantage in favour of RPN – WIT/EBL/LOS/and complications

*Aboumarzouk et al Eur Urol 2012;62
Froghi et al BJU Int 2013;Vol 112*

*Benway et al .J UROL 2009;182
Mullins et al Urology2012;80*

Comparing RPN to LPN

- ❖ Review of Prospective data bases from Six French centres RPN (220) and LPN(45)

Masson-Lecompte et al. BJU Int 2013;Vol 111,2

- ❖ Lower in RPN were :

- WIT 20.4 vs 24.3 (p=0.03)
- Op time 168 vs 199 p<0.001
- *Op room time 248 vs 268 p=0.01*
- *Haemostatic agents 78% vs 100 % p =0.01*
- LOS 5.5 vs 6.2

- ❖ These consistent with other large published RPN series

*Kaouk et al Urology2011;78
Benway et al Eur Urol 2010;57
Long et al Eur Urol 2012;61*

- ❖ 30% were complex 7-9 RENAL
- ❖ Caution – *half* post op complications were Clavien-3 (AVF/haematuria/urine leak)
- ❖ *Conclusion – not inferior, surgical outcomes better*

Equipose: Certainty About Uncertainty



Hilar vs Non-Hilar

- ❖ Multi institutional review of consecutive 446 cases

(Dulabon et al Europ Urol 2011;59)

- ❖ 9% had hilar tumours (n=41)

- Age, BMI, race, gender, ASA, tumour size, op-time , WIT, blood loss, conversion rate, LOS, path criteria, complications

- ❖ Results for WIT:

- *Only sex and max tumour size were SS*
- *WIT was SS for hilar 26.3 ± 7.4 (vs 19 ± 10.4)*

- ❖ Complications 2.4% vs 5.4% !

- ❖ Transfusion lower in hilar (2.4% vs 5.4%)!

- ❖ Pathology – no sign difference

- ❖ 2nd endpoint:

- Hilar group ↑ malignancy 90 vs 73%
- Increased median tumour size

- ❖ Similar to single-arm multi-institutional analysis of 11 pts

(Rogers et al JUrol 2008;180)

The Learning Curve Effect

- ❖ All had considerable lap experience (*Dulabon et al*)
- ❖ All attempted complex early
- ❖ Number of hilar tumours per year (9- 12 %)
- ❖ WIT didn't come down with experience
- ❖ Timing in which conversions occurred similar

Arguing *against* learning curve effect

- ❖ Large single series (n=800) surgical skill set and confidence increased with time (*Gill et al J Urol 2010;183*)
 - ❖ Published series 62 consecutive RPN that demonstrated optimal WIT achieved after 30 cases. (18.5min) (*Mottrie et al Eur Urol 2010;58*)
 - Small sample size
 - Didn't discuss in relation to tumour complexity.
-

Learning curve

- ❖ Prospective single-surgeon, single-centre review
- ❖ 108 patients
- ❖ August 2008 to August 2014
- ❖ Individual PADUA nephrometry scores are evaluated against:
 - Learning curve parameters
 - Clavian Dindo complications

Results

108 RAPN

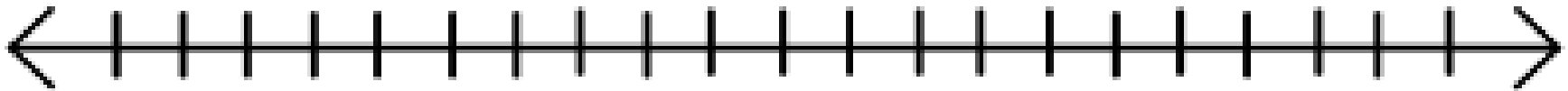
PADUA ≤ 8

CT <120 mins:
Case No. 10

**The first attempted PADUA
Score-9 was case 23**

Extra 10

PADUA >8 Cases
CT <120 mins:
Case No. 45



1

PADUA ≤ 8

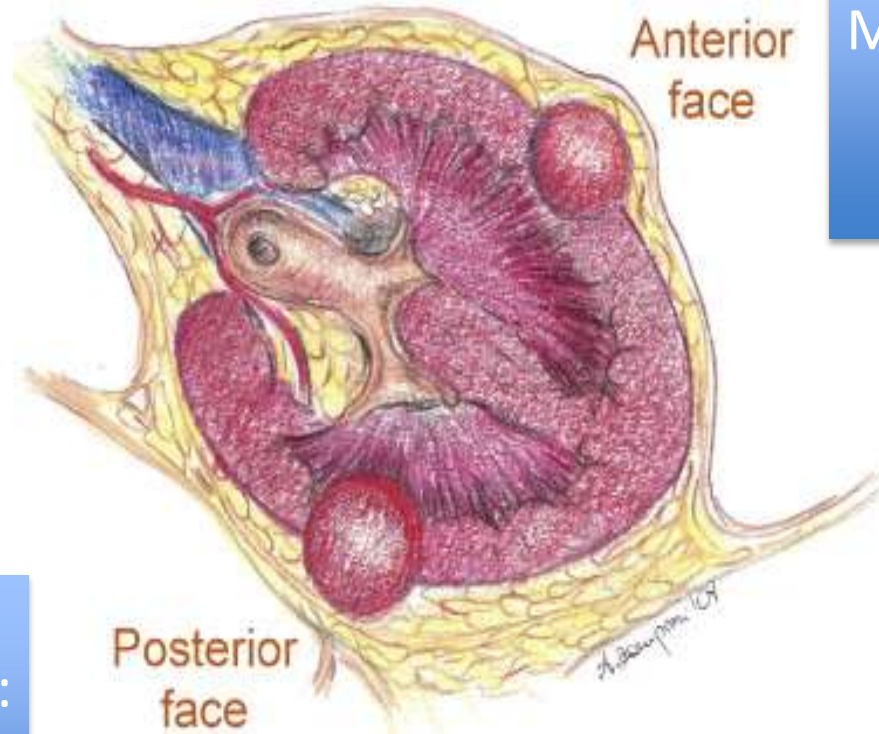
WIT <20 mins:
Case No. 20

Extra 5

PADUA >8 Cases
WIT <20 mins:
Case No. 36

108

Anterior vs Posterior Tumours



Mean CT 100 mins:
Range (40– 178)

Mean CT 125 mins:
Range (65– 184)

Anterior and Posterior Tumours

	PADUA ≤ 8	PADUA > 8	
Warm Ischemic Time (mins)	15	16.8	0.029
Console Time (mins)	121	130	0.203
Blood Loss (ml)	293	377	0.720
Clavian-Dindo Score > 2	13.1%	13.7%	0.905
Positive Surgical Margins	1.7%	3.1%	0.103
Mean Change in GFR (ml/min/1.73m²)	5.3	5.9	0.950

Complications

One Positive Surgical Margin / Incomplete Excision
(Endophytic poorly defined upper pole posterior tumour)



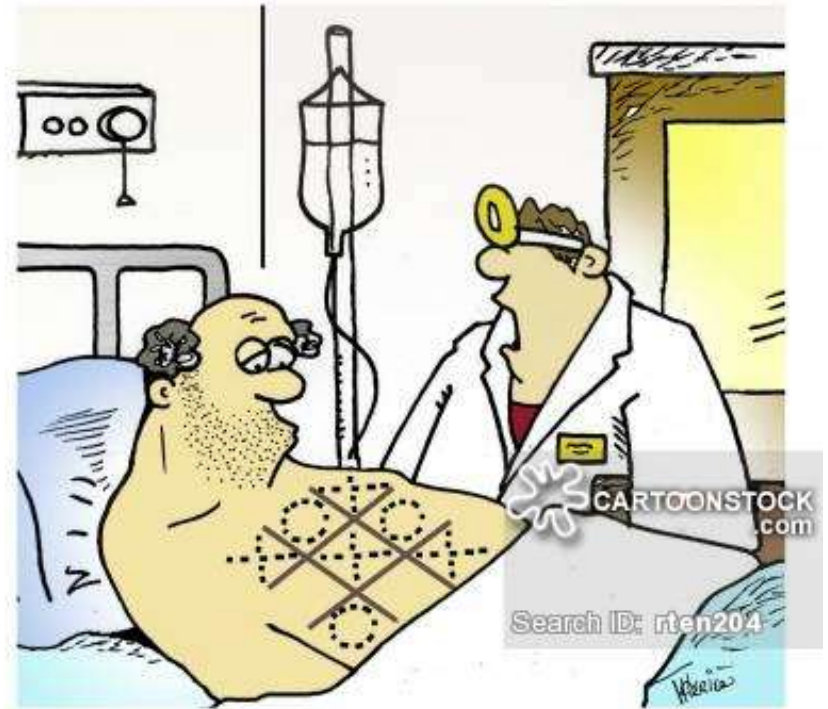
One Conversion to Open Partial Nephrectomy
(Cystic Tumour Rupture)

Learning Curves in RA-PN

Nephrometry scoring creates opportunity for RA-PN modular training.

It provides an objective parameter of difficulty, allowing for *graded case progression*.

Only tumours with PADUA scores *of less than or equal to eight* and *anterior* tumours should be attempted during the *first twenty case* learning curve.



"It was a difficult operation but in the end, I won."

Larger Tumours

- ❖ 4 centres perioperative outcomes of RPN in >4 cm renal tumors vs ≤4 cm tumors (n=49)
- ❖ Retrospective
- ❖ Median WIT 22 mins (18-28)
- ❖ Blood loss 120 (60-237)
- ❖ Periop complications (26.5% with Major in 8.2%)
- ❖ *Larger tumours peri-operative outcomes are worse*
- ❖ *No differences in surgical margins*
- ❖ *Oncologically safe and an alternative to open partial nephrectomy*

Larger Tumours

- ❖ Non systematic review Medline database reviewing reports on complex T1a or T1b
- ❖ Promising results in terms of perioperative functional and oncological outcomes
- ❖ RPN – longer WIT/op time/blood loss compared to small masses *but still feasible*

Borghesi et al World J Urol. 2013 ;31(3)

Volpe et al Curr Opin Urol. 2013 Sep

Cystic Tumours

- ❖ Cystic renal masses vs solid renal masses (1:1 matching) by age, gender, tumour size, and nephrometry score.
- ❖ 647 cases : 55 cystic vs 55 solid.
- ❖ *No cystic rupture* or positive margins
- ❖ Volume of *resected rim* of healthy renal parenchyma surrounding the tumor was the same for both groups (p=0.9)
- ❖ No diff in GFR/complications

NSS with robot effective tool for treating suspicious cystic renal neoplasms RPN can be safely and effectively performed with outcomes resembling those obtained for solid masses

Robot Assisted Partial Nephrectomy for T2 Tumours

❖ >7 cm Mostly exophytic

❖ 29 cases compared to < 4cm controls (n= 412)

Op time <i>longer</i>	200 vs 180 (p<0.001)
Warm Ischaemic Time <i>longer</i>	26.5 vs 19 min (P <.001)
Complication <i>higher</i>	37.9 vs 15.8 (Clavian 3 comparable)
Transfusion <i>higher</i>	24 vs 4 % (p<0.01)
GFR decline <i>similar</i>	12.2 vs 15.8 (p=0.98)
Positive Margin <i>similar</i>	

Feasible and safe nephron-sparing surgery approach for highly selected T2 tumours (mostly exophytic, polar)

Zero Ischaemia

- ❖ Hypotensive anaesthesia- short , vasodilated ,high flow state, with preserved peripheral O2 delivery
 - ❖ 21 robotic, 7 hilar
 - Tumour size 4.1 (2.6-6.4)
 - Op time 222 (160- 330)
 - Blood loss 150ml
 - Median ↓ in creatinine was 0 and GFR 5
 - ❖ Considerations :
 - *Cardiorespiratory , cerebrovascular comorbidities*
 - *Electrocautery and charring*
 - *with early unclamping (14 min) the benefit of reducing 14 min to zero is unproven.*
-

Intracorporeal Cooling and Extraction (ICE)

- ❖ Transperitoneal ($n = 5$) and retroperitoneal ($n = 2$)
- ❖ Ice slush introduced through the Gelpoint via syringes and applied over the kidney surface.
- ❖ Excised tumor immediately extracted allowing gross margin assessment by pathology during renorrhaphy.
- ❖ Mean cold ischemia time was 19.6 min (range: 8–37)
- ❖ *Renal parenchymal temperatures $<16^{\circ} \text{C}$ were achieved within 7 min of cold ischemia*
- ❖ *No drop in core body temperature $>0.5^{\circ} \text{C}$*

Intracorporeal Cooling and Extraction (ICE)



Near Infra-red Fluorescence Imaging

❖ Indocyanine Green Dye

- ❖ Prospective Comparative Study of 47 pts compared to prev 47 pts without ICG
- ❖ Mean warm ischemia time was significantly decreased in the ICG group (15 vs 17 minutes, $P = .01$)

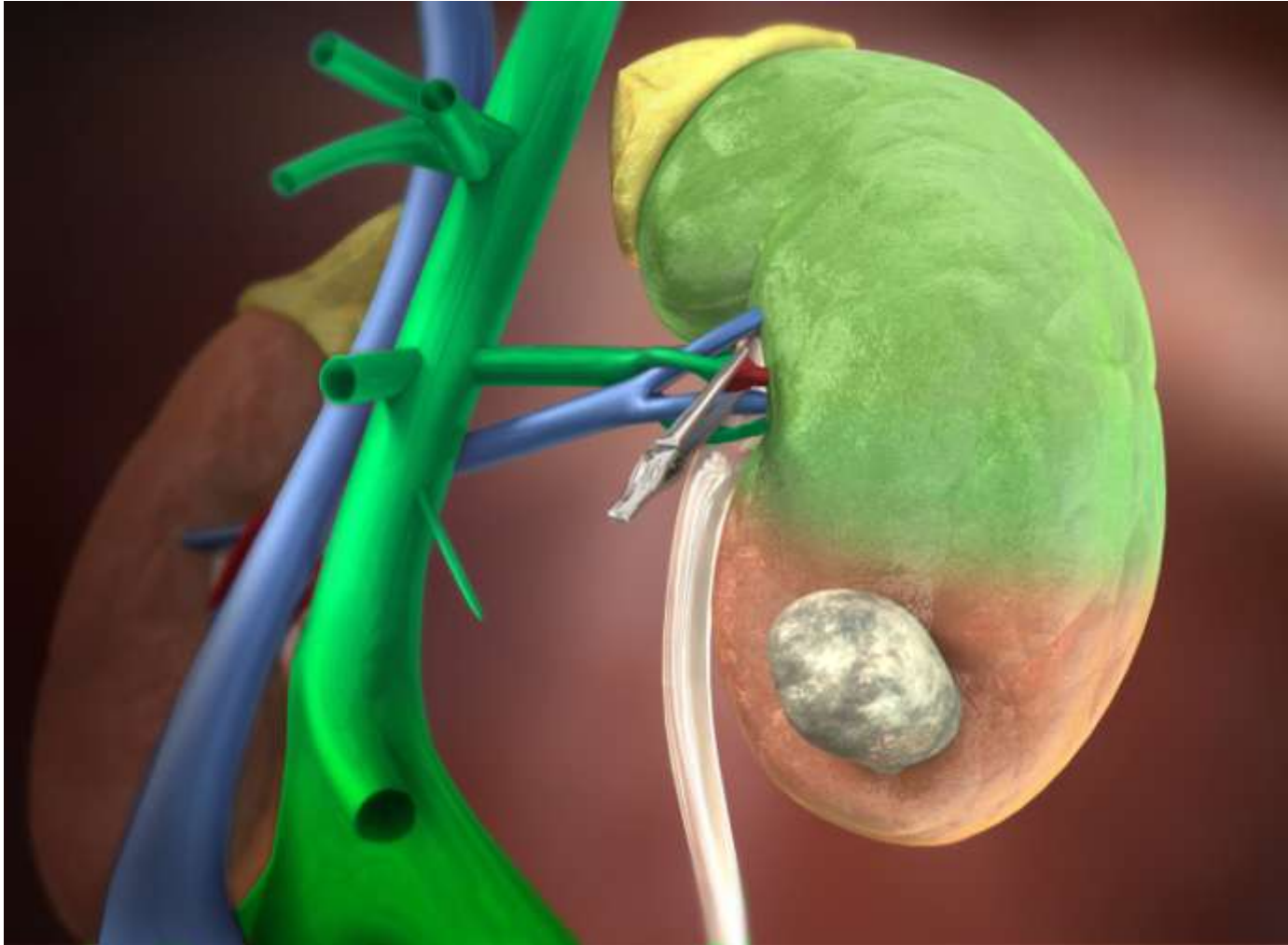
Krane et al Urology July 2012;Vol 80;Issue1

- ❖ Super-selective arterial clamping during zero-Ischaemia RPN
- ❖ Matched pair analysis : “ZI” RPN vs conventional RPN (both $n = 27$)
- ❖ Seven (20.6%) required conversion to main renal artery clamping (Ischaemia time <30 min)

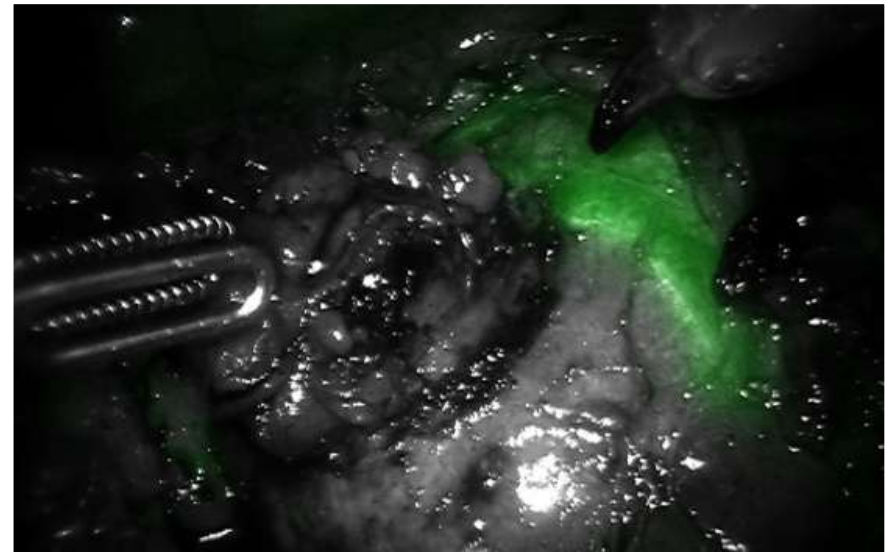
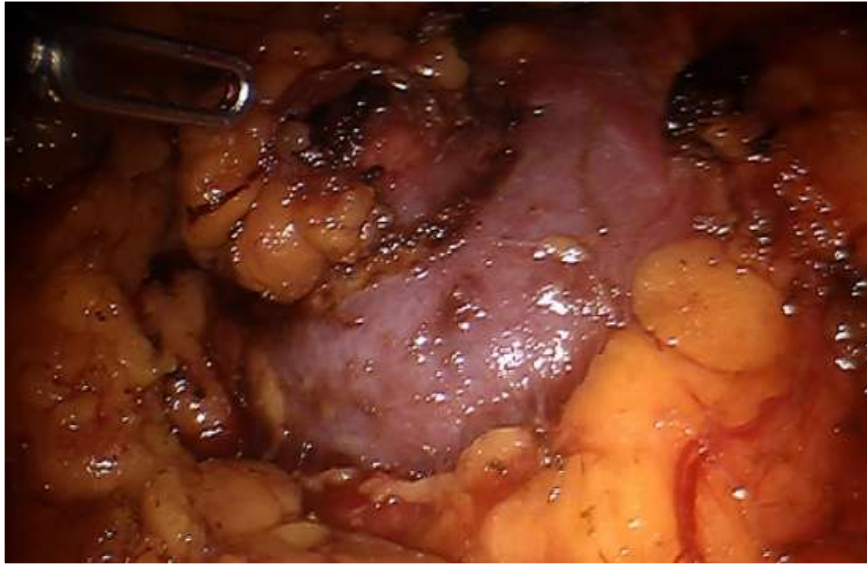
- ❖ Eliminating global Ischaemia may improve functional outcomes

Borofsky et al BJU Int April 2013 Volume 111

Selective Clamping



Near Infra-red Fluorescence Imaging



Conclusion

- ❖ Limits of robotics are not determined by the technology : they are derived out of surgeons experience
- ❖ In challenging settings Robotics is at least equivalent , safe and feasible with some advantages
- ❖ The limits will continue to expand
- ❖ Every man is a damn fool for at least five minutes every day; wisdom consists in not exceeding the limit....Elbert Hubbard

Thank you