Training in LD Nephrectomy: The Trainer's perspective

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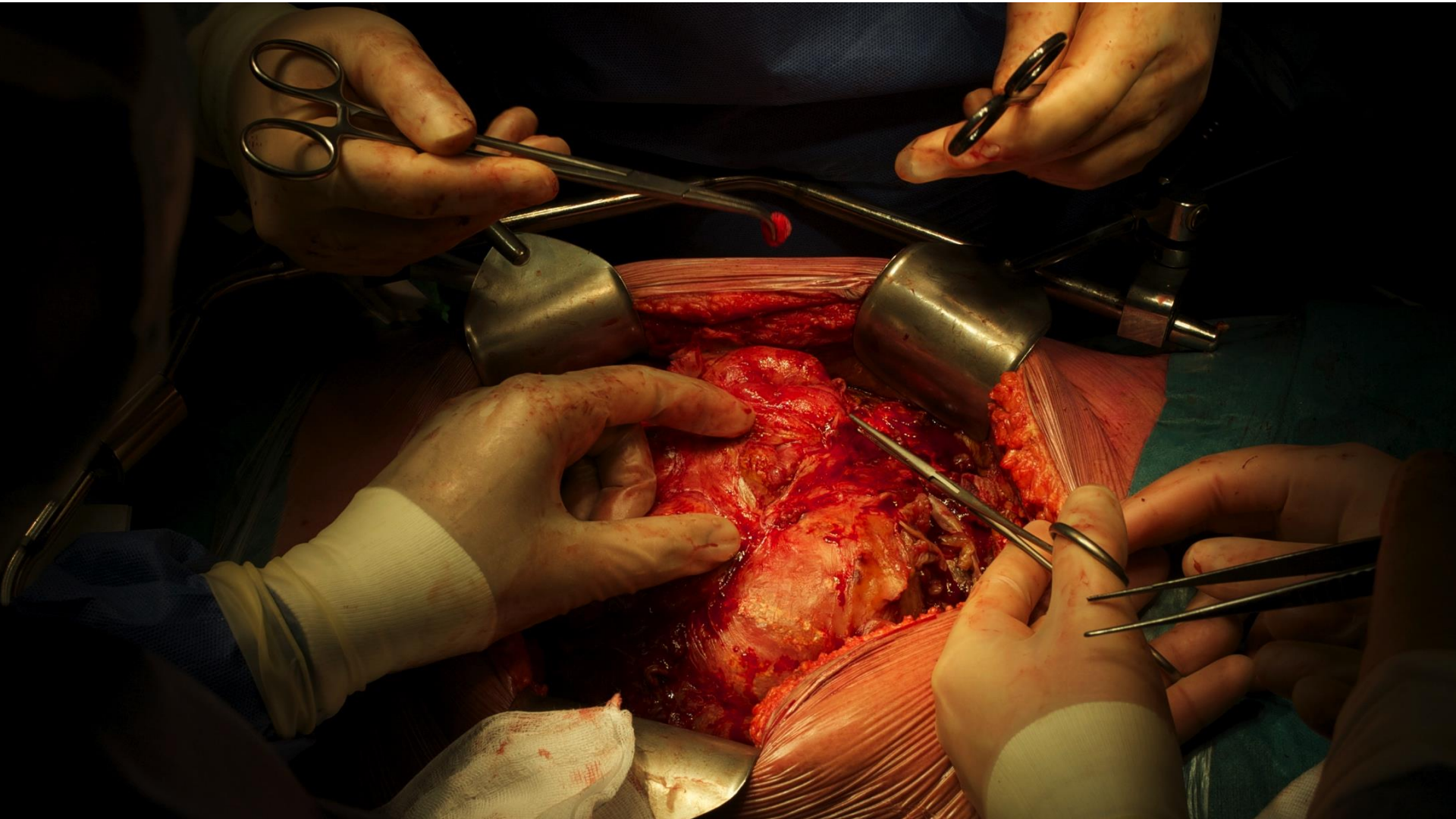
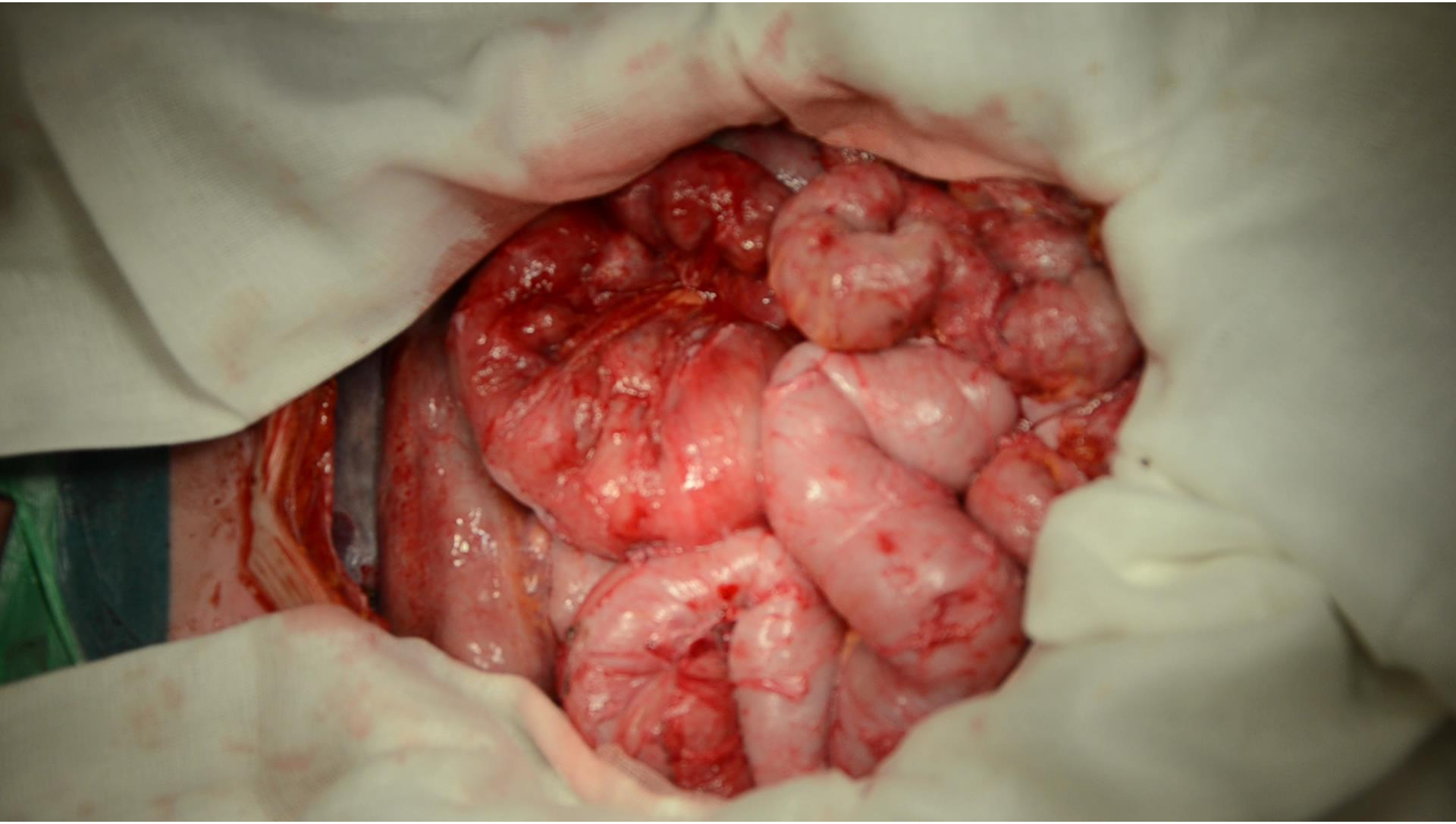
Congratulations to 50 yrs Transplantation in Manchester !

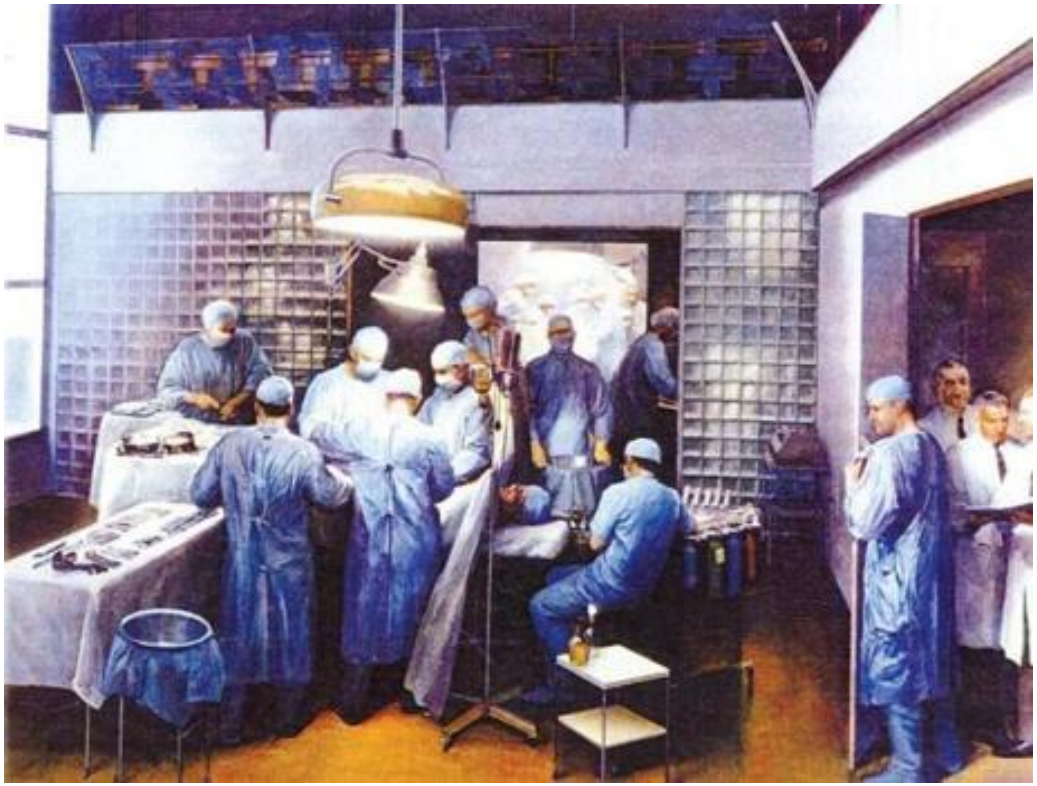


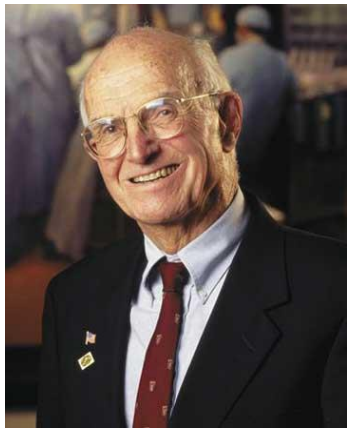




Live Kidney Donation

1954 Dr. Joseph Murray, Boston, USA





Advantages Live Kidney Donation

Elective surgery

Advantages for recipient:

- pre-emptive Tx: prevent dialysis
- alternative programs: AB0i, HLAi, paired exchange, unspecified
- well screened, healthy donor
- short cold ischemia -> superior graft function
-”impossible transplants"

Economic advantages:

- each kidney transplant saves 800.000 Euro / 10 yrs !!

7th Kidney Transplant

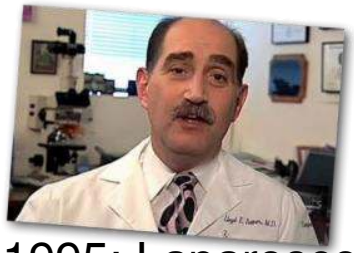
Imperial College Healthcare NHS
NHS Trust

SURGICAL REVOLUTION

- Original technique:

  1950: Flank incision (15-25 cm)

- Current techniques:

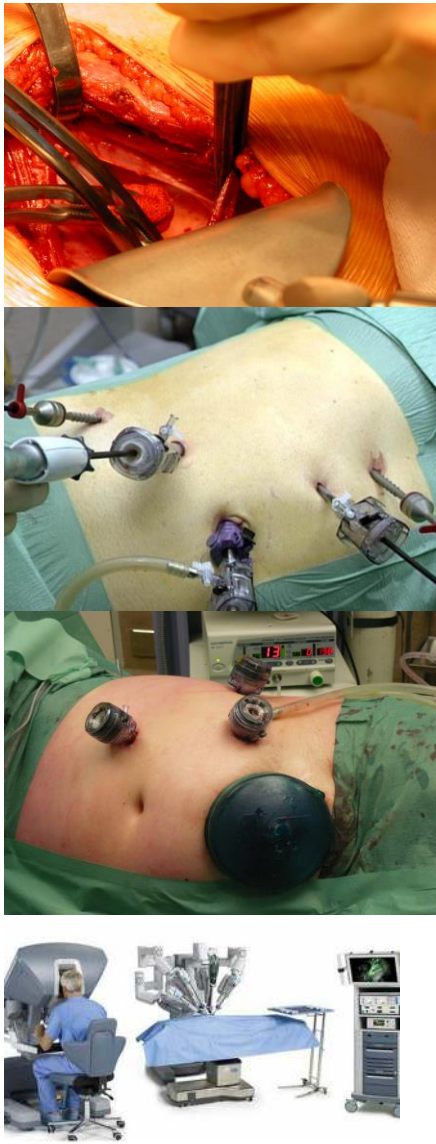



  1995: Laparoscopic donor nephrectomy

  1995: Mini-incision (7-15 cm)

  2002: Hand-assisted retroperitoneoscopic technique

  2009: Robot-assisted laparoscopic technique



Live Kidney Donation:

- No mortality, No Morbidity
- No harm to the kidney
- No long-term risk
- Good QoL and quick recovery

However:

- –"Major" surgery on healthy person
- –No direct therapeutic benefit for the donor
- –Mortality 1 in 3000 (1 in 8000 in Kortram et al. Transplantation 2016)
- –Morbidity 2.3% (intra-op), 7.3% (post-op) Kortram et al. Transplantation 2016

Donor safety and QoL

- **Screening:**
  - Medical: short-term vs long-term
  - Surgical: short-term vs long-term
  - Psychological: short-term vs long-term

  -> Absolute vs relative contra-indications to donation

- **Operative Techniques & Training**
- **Long-term follow up**
- **Safety nets**

The era of surgeon driven approaches

Procedure	N (%)
Open	
Mini-incision	1436 (4.5)
Laparoscopic	
trans-peritoneal	18374 (57.4)
Retro-peritoneal	1107 (3.7)
Anterior approach	
Lumbar approach	
Hand assisted	
trans-peritoneal	8112 (25.3)
Retro-peritoneal	1300 (3.8)
Single port laparoscopic (SILS)	1214 (3.8)
Robotic assisted	417 (4.5)
NOTES	78 (0.2)

Kortram K et al. Transplantation 2016;100(11):2264-2275

Complications live donor nephrectomy

Review

Perioperative Events and Complications in Minimally Invasive Live Donor Nephrectomy: A Systematic Review and Meta-Analysis

Kirsten Kortram, MD,[1] Jan N.M. Ijzermans, MD, PhD,[1] and Frank J.M.F. Dor, MD, PhD[1]

Kortram K et al. Transplantation 2016;100(11):2264-2275

TABLE 2.

Conversions, intraoperative and postoperative complications, reinterventions and mortality after minimally invasive live donorn nephrectomy

	No. Articles	No. Nephrectomies	No. events	%
Conversion (ALL)	160	28376	316	1.1
Emergent	149	27694	189	0.7
Bleeding	145	27694	185	0.7
Injury other organs	149		4[a]	0.01
Intraoperative Complications (ALL)	173	27776	612	2.2
Bleeding	175	27776	391	1.5
Injury other organs	153	2644026	221	0.8
Spleen	151	26440264	97	0.4
Bowel	153	40	49	0.2
Bladder	151	26440	12	0.05
Liver	151		14	0.05
Adrenal gland	151		22	0.08
Other	151		27[b]	0.1
Postoperative Complications (ALL)	187	30970	2174	7.0
Bleeding (ALL)	176	30443	290	1.0
Requiring transfusion	175	29443	128	0.4
Requiring intervention	173	29878	60	0.2
Injury to other organs (ALL)	170	28562	26	0.09
Bowel	170	28562	14	0.05
Spleen	167	28074	6	0.02
Bladder	167	28074	3	0.01
Pancreas	167	28074	3	0.01
Infectious complications (ALL)	163	26729	697	2.6
Wound infection	158	25650	405	1.6
Abscess	152	25910	19	0.07
Urinary tract infection	141	23573	105	0.4
Pneumonia	153	25808	148	0.6
Thoracic Empyema	104	19845	1	0.01
Infectious—other[c]	111	19785	12	0.06
Fever e causa ignota	55	11095	71	0.6

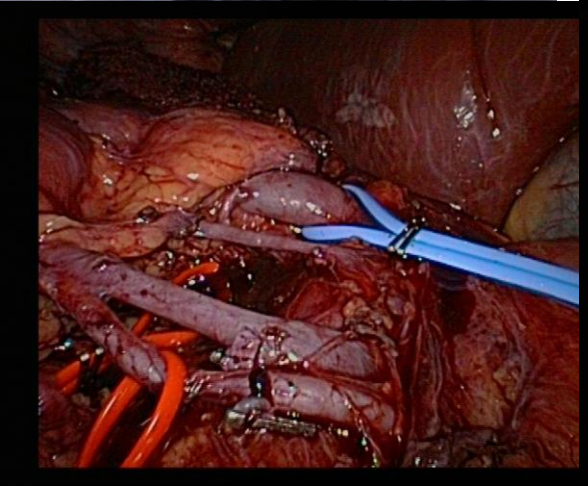
TABLE 2.

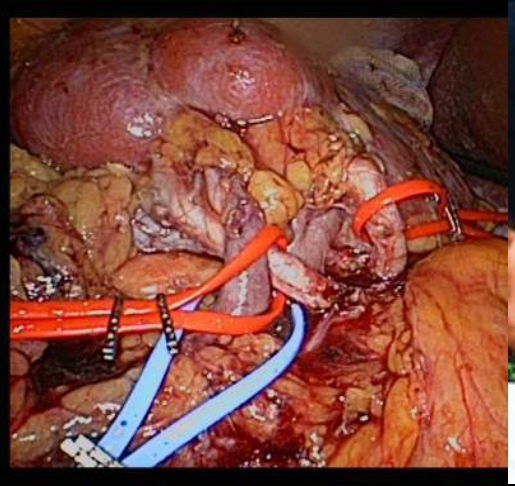
Conversions, intraoperative and postoperative complications, reinterventions and mortality after minimally invasive live donorn nephrectomy

	No. Articles	No. Nephrectomies	No. events	%
Cardiopulmonary complications				
Cardiovascular	148	25431	18	0.07
Cerebrovascular	149	25475	1	0.004
Pneumothorax	150	25842	36	0.1
Pulmonary—other[d]	113	20436	71	0.3
Thromboembolic complications	146	23574	39	0.2
Gastro-intestinal complications				
Ileus	138	24958	187	0.7
Small bowel obstruction	58	13854	30	0.2
Chylous ascites	78	17564	81	0.5
GI—bleed	88	16022	5	0.03
GI—other[e]	62	12399	115	0.9
Other complications				
Fascial defect	121	22532	3692	0.2
Testicular swelling/pain/epididymitis	63	14390	32	0.6
Thigh numbness	51	11235	95	0.3
Pain	61	12062	24	0.8
Remnant kidney function disorder	41	8681	100	0.3
Urinary retention	100	19537	2	0.5
Drug reaction	38	7065	194	0.03
Other general complications[f]	101	20030		1.6
Mortality	142	25116	3	0.01
Surgical reinterventions	163	28516	165	0.6

[a] Injury to other organs included spleen (2), bowel (1), mesentery (1).
[b] Other organs/structures include: pancreas (4), gallbladder (1), diaphragm (18), mesentery (4).
[c] Other infectious complications included sepsis (3), pyelonephritis (1), phlebitis (8).
[d] Other pulmonary complications included atelectasis (35), respiratory distress (13), pulmonary edema (8), pleural effusion (10), hypoxia (5).
[e] Other GI complications included gastroenteritis (58), pancreatitis (11), constipation (13), liver function disorder (24), appendicitis (4), cholecystitis (2), gastric ulcer (3).
[f] Other general complications included: Seroma (68), neuropathy/neurapraxia (23), subcutaneous emphysema (18), ocular complications (16), rhabdomyolysis (12), skin complications (16), electrolyte disorder (8), urethral injury (12), headache (4), ear hematoma (1), parotitis (1), depression (5), vertigo (1).

Extended Criteria Live Kidney Donors



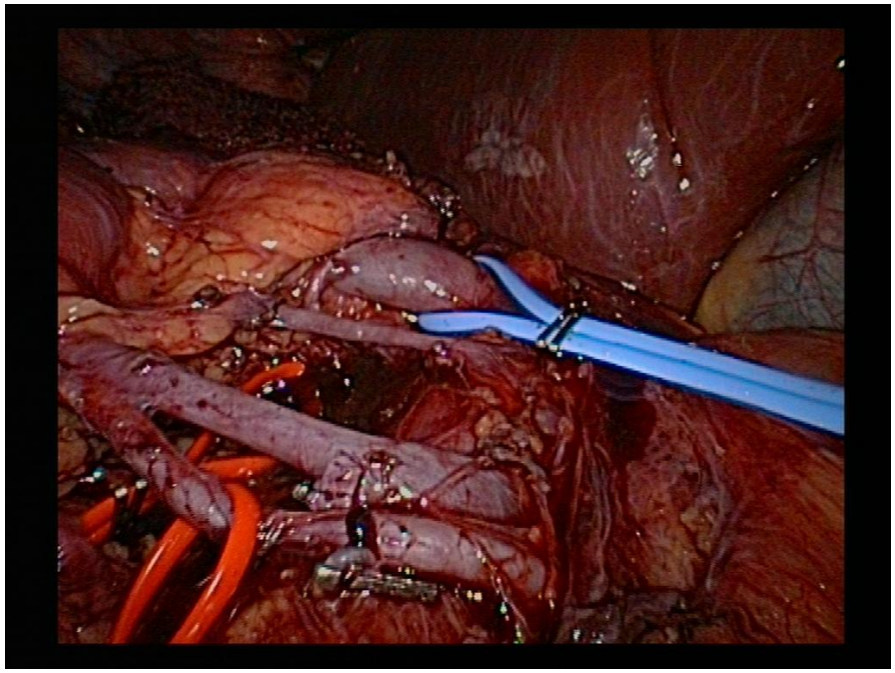


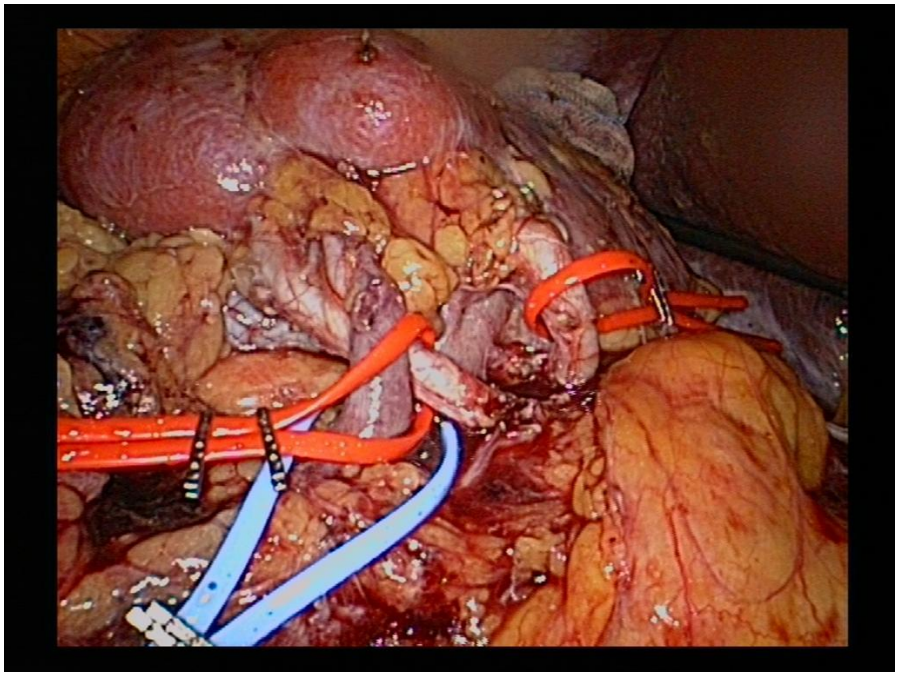
Challenges in Live Kidney Donation

Obesity

Challenges in Live Kidney Donation

Vascular multiplicity





So, how do we teach

live donor nephrectomy?

Laparoscopic Donor Nephrectomy Training in the UK: Results From an Independent Trainee Survey.

Sharma, H.[1,2]; Wong, C.[1]; Al-Bakry, A.[1,2]; Ridgway, D.[1]; Sharma, A.[1]; Mehra, S.[1]; Augustine, T.[2]; Hammad, A.[1]
Transplantation 2014;July 15 (98): 606.

- 96% < 10 laparoscopic donor nephrectomies as primary surgeon
- 58% first assistant in 11-25 donor nephrectomies
- 24% assisted in 26-50 donor nephrectomies
- 40% trainees had been on a course for donor nephrectomy.
- No correlation in seniority in training grade compared to donor nephrectomies as primary surgeon
- The likelihood of a trainee to perform >10 LDN in transplant training was < 1 in 25.

Conclusions: This study confirms poor training opportunities in LDN in UK. The trainers need to address this issue urgently. UK training system has no LDN fellowship training opportunities hence developing LDN fellowships can be a way forward.

My Training

- High volume centre (Rotterdam): 120->150 live donor nephrectomies/year
- “transplant surgery fellowship” during final year surgical residency: “only” Tx fellow: 2-3 live donors/week
- Trained by 3 different surgeons, common protocol/approach
- Good experience with laparoscopic surgery: appendicectomy, cholecystectomy, splenectomy, adrenalectomy, colectomies, etc.
- Within 6-9 months through learning curve (full lap, HARP, HALS), including more complex cases

Training in live donor nephrectomies

- Theory
- Videos/e-learning
- Cadaver course
- Assisting surgeon
- Proctoring (in own centre)
- Step up operating surgeon
- What is learning curve? -> varies and depends on previous laparoscopic experience

LIDO COURSE

28 - 30 June, 2017

Department of Surgery, division of HPB and Transplant Surgery,
Erasmus MC Rotterdam
SkillsLab, Erasmus MC Rotterdam, The Netherlands

INTERNATIONAL HANDS-ON COURSE

Live Donor Nephrectomy (LiDo course)

EDUCATION COMMITTEE

#PoweredByESOT

LIDO COURSE

since 2009, participants from:

- Belgium
- Netherlands
- Germany
- France
- Sweden
- Finland
- UK
- Italy
- Saudi Arabia
- Georgia
- Macedonia
- Slovenia
- South Africa
- USA
- Colombia
- Australia
- New Zealand
- Turkey
- Costa Rica
- Poland
- Russia
- Nigeria
- India
- Filippines
- Czech Republic
- Argentina

LIDO COURSE

- Focus on Hands on: 2 days of operating: choice of technique (Lapsc, HALS, HARP)
- Live demos
- 3rd day: 3 live cases in Theatres (different techniques)
- Short theoretical lectures / interactive
- Experts (1:2), faculty refreshed every year
- Building network
- Opportunities for proctoring

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What Should the Finished Product Be?

- Knowledgeable
- Competent
- Safe
- Efficient
- Independent
- Flexible
- Understanding of the recipient needs
- “Fearful”/Respectful of complications

“…..and smart people do stupid things far more often than most people realize.”

From:

The Mathematician’s Shiva

By

Stuart Rojstaczer

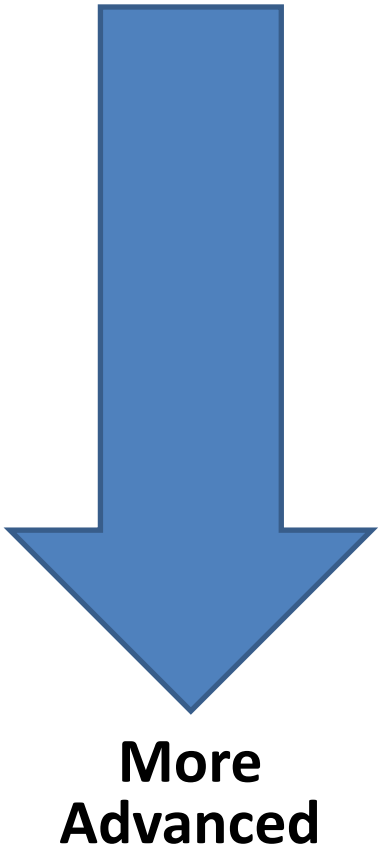
Ratner's Mantra

Meticulous attention to technical detail

Pre-requisites

- Laparoscopic experience
- Know donor history & work up
- Reviewed the CT Angiogram
- Seen the donor prior to surgery
- Know the equipment

Teaching LLDN



- Operative steps
- Understanding the operation
- Technical skills
- Mishap avoidance
- Damage control
- Anomalous anatomy
- Right side
- Unusual cases

Operative Steps

1. Port placement
2. Mobilization of the colon
3. Identification of ureter & gonadal vein
4. Dissection of the ureter
5. Identification & preservation of gonadal artery
6. Identification of renal vein
7. Dissection of renal vein
   - Division of lumbar veins
8. Dissection of Artery
9. Division of adrenal vein
10. Mobilization of the upper pole
11. Division of attachments between the artery & adrenal gland
12. Division of gonadal vein
13. Freeing remainder of the kidney from peri-renal fat & Gerota's fascia
14. Creation of Pfannenstiel Incision
15. Stapling of vessels
16. Delivery of kidney
17. Hemostasis
18. Check/repair mesentery
19. Closure
    - Ports
    - Pfannenstiel

General Principles

- Skills assessment
- Non-linear graduated approach
  - Master individual parts of the operation
  - Combine mastered parts
- Repetition in rapid succession
  - Each fellow scrubs on at least 3 LLDN in a row
- Start with the more difficult portions of the operation first
- Pose hypothetical situations
  - Improved exposure
  - Damage control
  - Open conversion

Phase I Training – Skills Assessment

Operative Steps

1. Port placement
2. Mobilization of the colon
3. Identification of ureter & gonadal vein
4. **Dissection of the ureter**
5. Identification & preservation of gonadal artery
6. **Identification of renal vein**
7. Dissection of renal vein
   - Division of lumbar veins
8. **Dissection of Artery**
9. Division of adrenal vein
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15. **Stapling of vessels**
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19. Closure
    - Ports
    - Pfannenstiel

Phase I Training – Skills Assessment

Operative Steps

- Laparoscopic sense
  - Where instruments are
  - Inserting instruments safely
- Working with 2 hands in concert
- Gentleness
- Precision
- Efficiency
- Knowledge of equipment

Phase II Training – Vascular Dissection

Operative Steps

1. Port placement
2. Mobilization of the colon
3. Identification of ureter & gonadal vein
4. Dissection of the ureter
5. **Identification & preservation of gonadal artery**
6. **Identification of renal vein**
7. **Dissection of renal vein**
   - **Division of lumbar veins**
8. **Dissection of Artery**
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19. **Closure**
    - **Ports**
    - **Pfannenstiel**

American Journal of Transplantation 2015; XX: 1–7
Wiley Periodicals Inc.

doi: 10.1111/ajt.13142

Brief Communication

Vascular Management During Live Donor Nephrectomy: An Online Survey Among Transplant Surgeons

S. Janki[1], D. Verver[1], K. W. J. Klop[1], A. L. Friedman[2], T. G. Peters[3], L. E. Ratner[4], J. N. M. Ijzermans[1] and F. J. M. F. Dor[1,*]

Donor deaths and bleeding complications can be prevented by using transfixation techniques on renal artery and vein.

Hem-o-Lock clips contra-indicated for donor nephrectomy

Phase II Training – Vascular Dissection

Operative Steps

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2. Mobilization of the colon
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4. Dissection of the ureter
5. **Identification & preservation of gonadal artery**
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18. Check/repair mesentery
19. **Closure**
    - **Ports**
    - **Pfannenstiel**

Phase II Training – Vascular Dissection

Operative Steps

- Three instruments
  - Atraumatic graspers
  - Suction-irrigator
  - Bipolar cautery (Ligasure)
- Subtle cues where branches are
- Get around tissue to avoid passed pointing
- Avoid getting too high into the hilum

Hypotheticals

- When you are in trouble is not the time to be devising a plan to get out of trouble
- Devise hypothetical situations at each point in the operation for discussion
- Bleeding
- Bowel injury
- CO_2 Embolus
- How to avoid open conversion
  - Additional port placement
  - Upsizing ports
  - Better retraction
- How to open convert (trainees with suboptimal open experience)
  - What type of incision
  - What additional resources are needed
  - Command and control of the OR

Phase III Training – Difficult Dissection

Operative Steps

1. Port placement
2. Mobilization of the colon
3. Identification of ureter & gonadal vein
4. Dissection of the ureter
5. Identification & preservation of gonadal artery
6. Identification of renal vein
7. Dissection of renal vein
   - Division of lumbar veins
8. Dissection of Artery
9. Division of adrenal vein
10. **Mobilization of the upper pole**
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18. Check/repair mesentery
19. Closure
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Phase IV Training – Easy Dissection (Should Know)

Operative Steps

1. Port placement
2. **Mobilization of the colon**
3. **Identification of ureter & gonadal vein**
4. Dissection of the ureter
5. Identification & preservation of gonadal artery
6. Identification of renal vein
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17. Hemostasis
18. Check/repair mesentery
19. Closure
    - Ports
    - Pfannenstiel

Phase V Training – Putting It Together

Operative Steps

1. Port placement
2. **Mobilization of the colon**
3. **Identification of ureter & gonadal vein**
4. **Dissection of the ureter**
5. **Identification & preservation of gonadal artery**
6. **Identification of renal vein**
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    - **Ports**
    - **Pfannenstiel**

Things I Do Myself – Little Educational Value

Operative Steps

1. **Port placement**
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18. **Check/repair mesentery**
19. Closure
    - Ports
    - Pfannenstiel

Summary & Conclusions

- Safety primary concern
- ”Takes” a while before the trainee really understands the operation
- Need to adjust for trainees’ differing skill sets
- Graduated, non-linear approach allows for trainee to spend the most time on the most difficult aspects of the case
- Minimize variation in approach, instruments, and technique
- Need to verbally rehearse hypothetical adverse events
- After mastering each portion of the operation trainee is then capable of putting it all together

Imperial College Renal and Transplant Centre, Hammersmith Hospital, London, UK

- One of the few centres with expertise all major minimally-invasive techniques for live donor nephrectomy:
  - Mini-open
  - Full laparoscopic
  - Hand-assisted laparoscopic
  - Hand-assisted retroperitoneoscopic
- Good opportunity for training!
- Patient choice
- Tailor-made approach

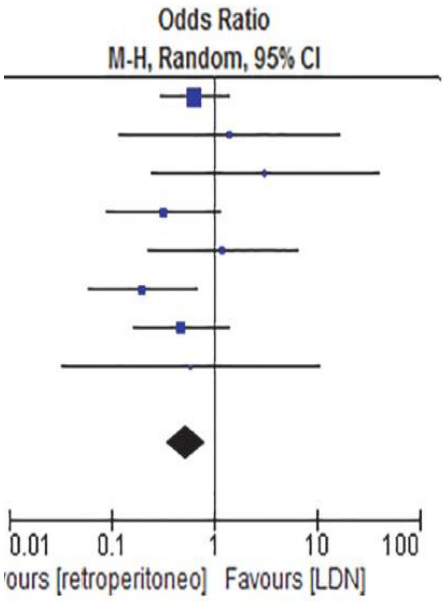
Imperial College Renal and Transplant Centre, Hammersmith Hospital, London, UK

- Training done by one consultant transplant surgeon
- Tailor-made approach to trainee (consultant, fellow) based on previous experience, in different techniques
- Simulation training for all theatre staff

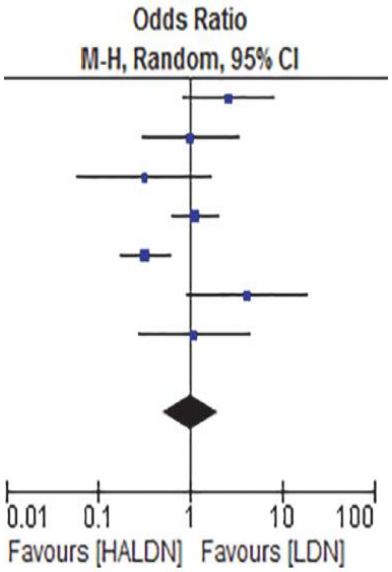
Which surgical approach?

Laparoscopic – How? Key questions?

- **Transperitoneal vs retroperitoneal**
  - Retroperitoneal – less complications



- **Hand assisted vs full lap**
  - No differences if hand assistance used



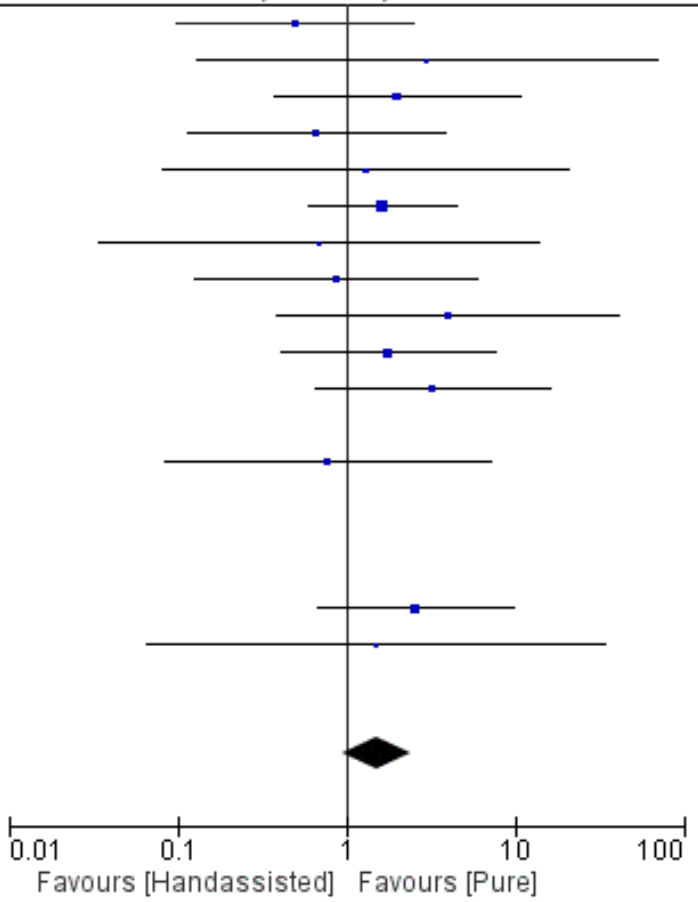
Kortram K et al. Transplantation 2016;100(11):2264-2275

Bleeding

Study or Subgroup	Handassisted Events	Total	Pure Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
You 2015	2	30	4	30	8.4%	0.50 [0.10, 2.53]	2015
Klop 2014	1	20	0	20	2.2%	3.00 [0.13, 69.52]	2014
Dols 2014	4	95	2	95	7.9%	2.00 [0.38, 10.66]	2014
Choi 2014	2	80	3	80	7.1%	0.67 [0.11, 3.88]	2014
Lucas 2013	1	116	1	152	2.9%	1.31 [0.08, 20.73]	2013
Broers 2013	4	50	24	494	21.3%	1.65 [0.60, 4.56]	2013
Ungbhakorn 2012	0	23	2	82	2.4%	0.69 [0.03, 13.92]	2012
Lai 2010	2	52	2	45	6.0%	0.87 [0.13, 5.90]	2010
Dols 2010	2	20	1	40	4.0%	4.00 [0.39, 41.51]	2010
Branco 2008	4	67	3	89	10.3%	1.77 [0.41, 7.65]	2008
Percegona 2008	4	21	2	34	8.5%	3.24 [0.65, 16.16]	2008
Bargman 2006	0	20	0	20		Not estimable	2006
Ruszat 2006	1	34	3	79	4.5%	0.77 [0.08, 7.18]	2006
Buell 2004	0	31	0	28		Not estimable	2004
El-Galley 2004	0	17	0	28		Not estimable	2004
Velidedeoglu 2002	0	60	0	40		Not estimable	2002
Lind 2002	2	8	9	93	12.1%	2.58 [0.67, 9.98]	2002
Ruiz-Deya 2001	1	23	0	11	2.3%	1.50 [0.07, 34.13]	2001
Johnson 2001	0	10	0	5		Not estimable	2001
Total (95% CI)		**777**		**1465**	**100.0%**	**1.52 [0.95, 2.43]**	
Total events	30		56				

Heterogeneity: Tau² = 0.00; Chi² = 6.09, df = 13 (P = 0.94); I² = 0%

Test for overall effect: Z = 1.74 (P = 0.08)



Learning curve?

Establishing a Learning Curve for Laparoscopic Living Donor Nephrectomy.

Z. Ahmed, R. Tamburrini, R. Uwechue, P. Chandak, F. Calder, N. Kessaris, N. Mamode.

ATC 2016

- 2 surgeons >180 LDNs. Cumulative sum analysis (CUSUM): operating time, hospital stay, occurrence of major and minor complications, need for readmission or reoperation

- Learning curve: inflexion point which would represent a stability of process?Number of procedures required to arrive at this point was assumed to represent successful ascent of the learning curve.

- CUSUM analysis:no discernible inflexion points for hospital stay (zL = 0.3 p=0.07), occurrence of Clavien 2 and above complications (zL =0.84, p=0.337), readmission (zL=0.696 p=0.243) or reoperation (zL= -0.366 p=0.643).

- Operating time: a visible stability of process initially at case 25 but this was more sustained by case 40 to 45 for both surgeons.

- **True ascent of the learning curve may mean the performance of up to 50 procedures rather than 20 – 25.**

Defining the Tipping Point in Surgical Performance for Laparoscopic Donor Nephrectomy Among Transplant Surgery Fellows: A Risk-Adjusted Cumulative Summation Learning Curve Analysis.

Serrano OK[1], Bangdiwala AS[2], Vock DM[3], Berglund D[1], Dunn TB[1], Finger EB[1], Pruett TL[1], Matas AJ[1], Kandaswamy R[1]. Am J Transplant. 2017 Jul;17(7):1868-1878.

- **UNOS**: fellowship-trained surgeons participate in 15 LDNs procedures to be considered proficient. **ASTS**: mandates 12 LDNs during an abdominal transplant surgery fellowship.

- Retrospective intraoperative case analysis (risk-adjusted cumulative summation (RACUSUM) model) to assess the learning curve of 30 novice Tx fellows.

- Measures of surgical performance included intraoperative time, estimated blood loss, and incidence of intraoperative complications.

- Rates of adverse surgical events novice fellows>senior fellows.
  Univariable analysis: multiple renal arteries, high BMI, prior abdominal surgery, male donor, and nephrolithiasis were correlated with higher incidence of adverse surgical events.
- RACUSUM model:
  - -high intraoperative time is mitigated after 28 procedures,
  - -incidence of intraoperative complications tends to diminish after 24 procedures
  - -improvement in estimated blood loss did not remain consistent.

- **Fellows' tipping point in LDN performance by 24-28 cases and proficiency by 35-38 cases**.

SAGES 2018

Training Techniques in Laparoscopic Donor Nephrectomy

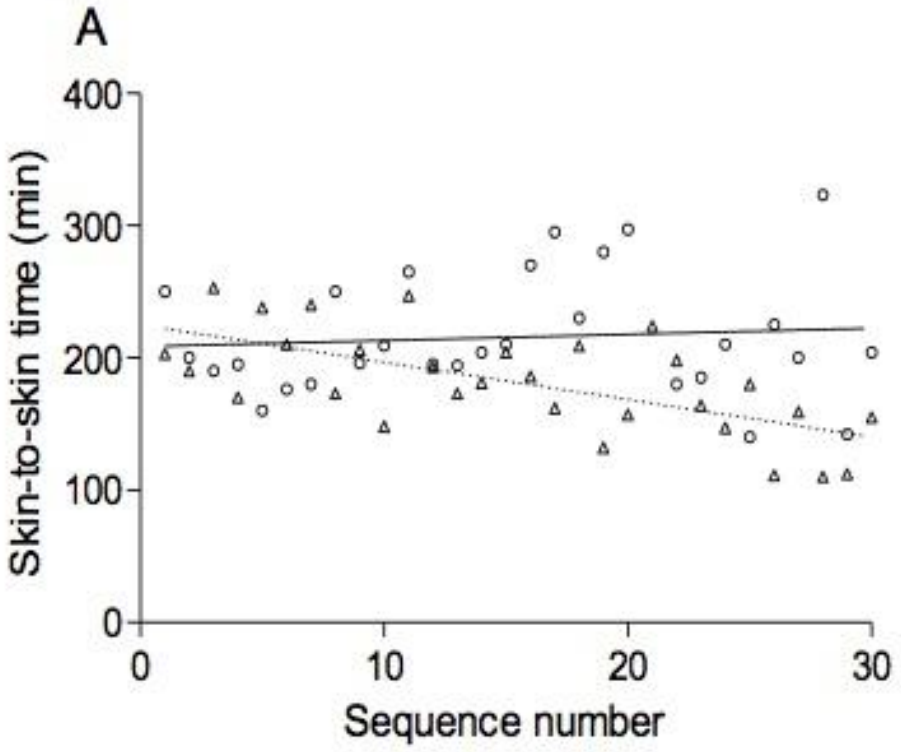
Adrian Billeter, MD, PhD, Elizabeth Lucich, Soloman Levy, MD, Eric Davis, MD, Michael Marvin, MD, Erica Sutton, MD

- Systematic Review. Majority centers performing <25 LDN/ year each year
- Simulation-based training methods were discussed in 4 articles, all of which described the use of *porcine* models.
- The proffered learning curve averaged 35 cases (range 10-95) measured as a decrease in operating time.
- Improved intraoperative, patient and recipient outcomes were observed for **centers performing ≥50 LDN annually when compared to centers <25 LDN.**
- Current OPN Network recommendations:15 cases as surgeon or assistant for LDN fall well below the learning curve for high quality outcomes in LDN as described in the literature.
- Though simulation has demonstrated utility in ascending the learning curve for LDN, it is rarely discussed or evaluated as a training method.
- Assessment of training and competency for LDN: heterogeneous and objective learner-based metrics could help surgeons and institutions safely reach a quality standard for performing this high stakes operation.

Learning curves in full laparoscopic and hand-assisted retroperitoneoscopic donor nephrectomy.

Klop KWJ, Kok NFM, Tran TCK, Terkivatan T, Toorop R, P Berger, Dor FJMF, IJzermans JNM.

Figure x. Skin-to-skin times and linear regression of all operating surgeons for both LDN (circles with line) and HARP (triangles with dashed line). In panel E skin-to-skin times and for HARP for both surgeon E (squares with line) and F (diamonds with dashed line) are demonstrated.



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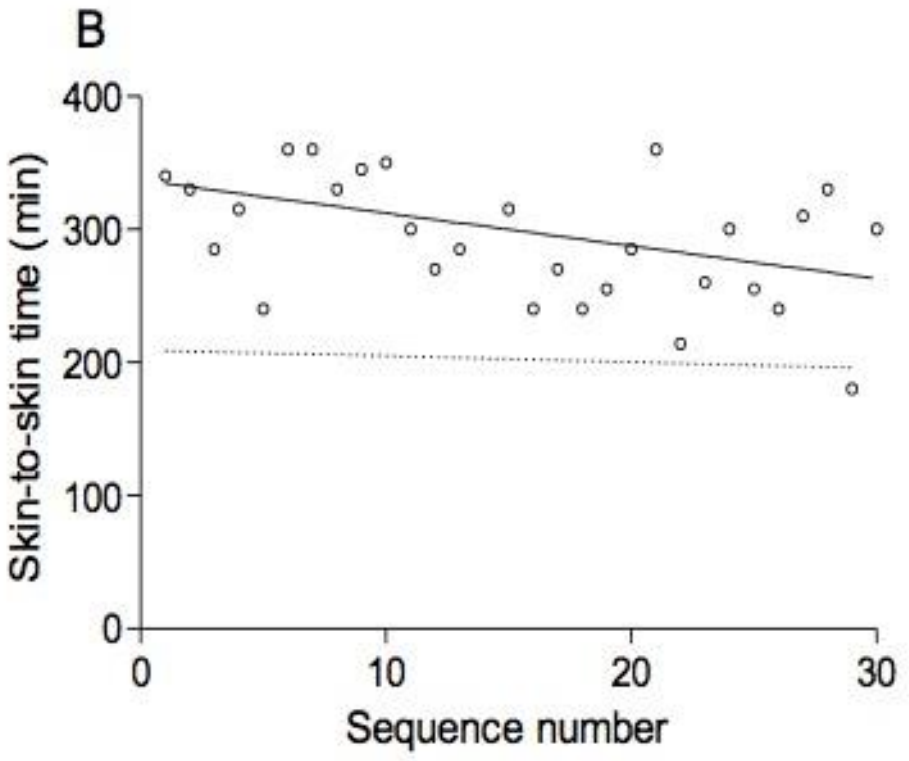

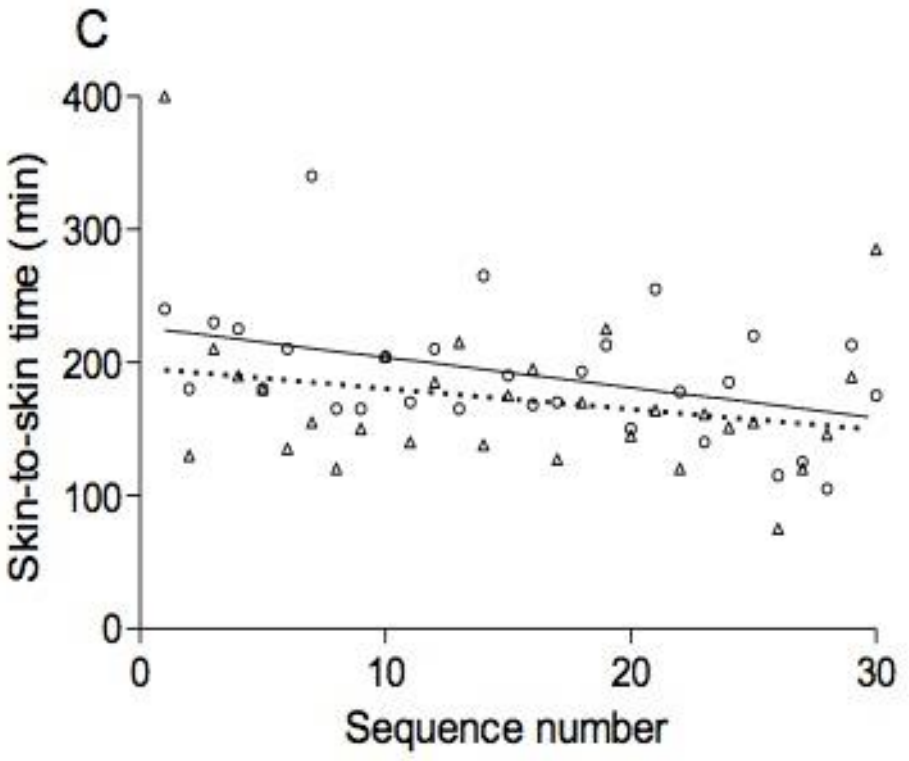

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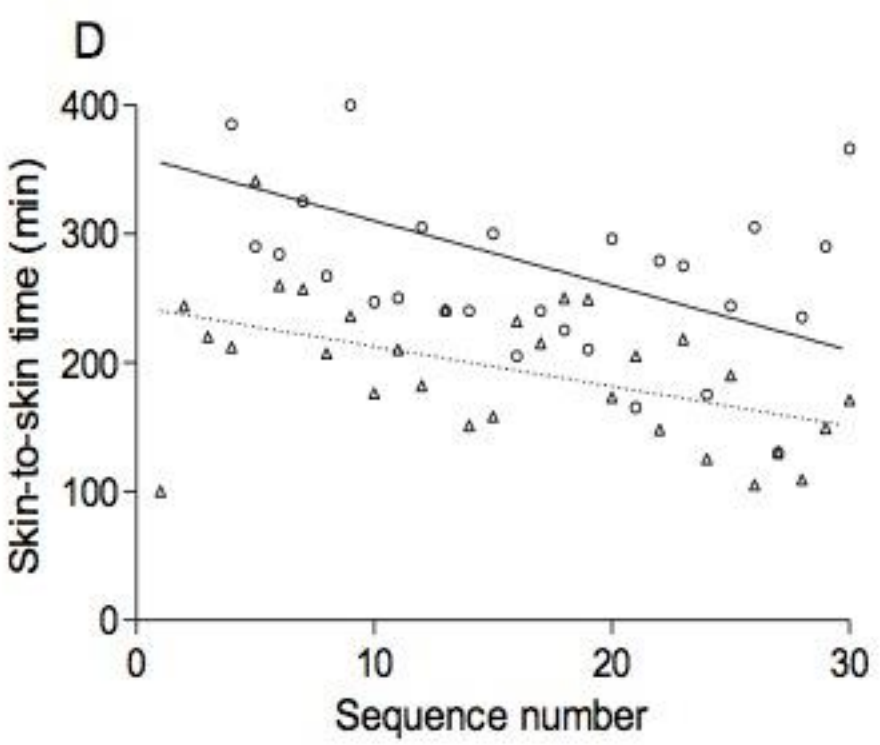
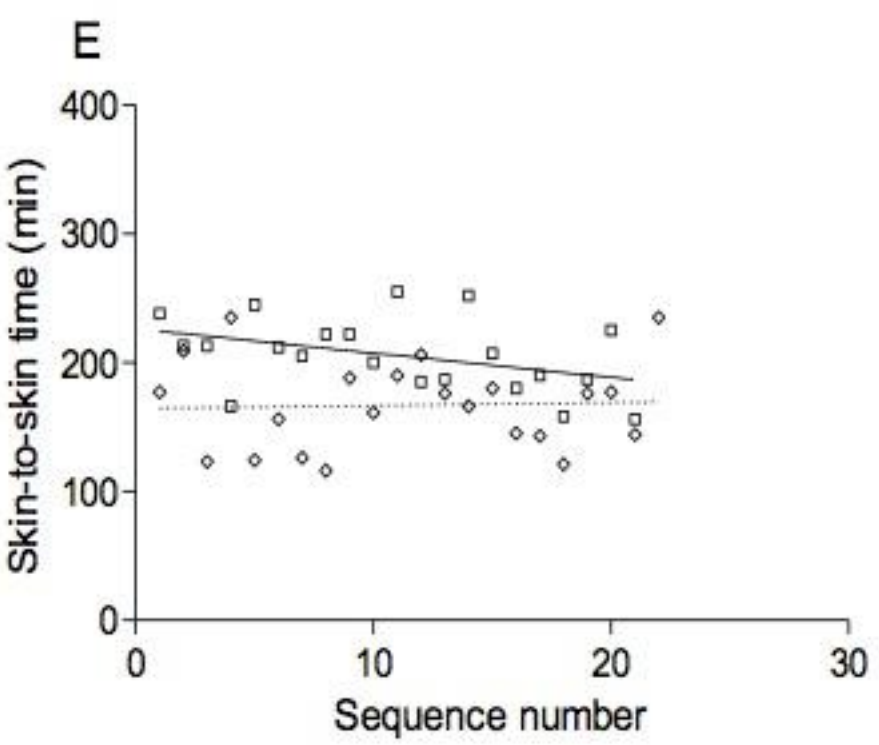




Retroperitoniscopic Hand-Assisted (HARP) Donor Nephrectomy as the Standard Procedure - Experience with the Transition from Anterior Approach Open Retroperitoneal Donor Nephrectomy

Stippel, D. L.[1]; Wahba, R.[1]; Özcan, H.[1]; Teschner, S.[2]; Kisner, T.[2] Transplantation 2012 Nov 27;94:p1107

- First 50 consecutive (HARP) compared to last 30 anterior approach open donor nephrectomies.

- To evaluate a learning curve operation time, blood loss and warm ischemia was compared for groups of ten consecutive patients each. For a comparison of the two approaches the 30 donors with the open approach (O) were compared to patients 21 - 50 with HARP (H) procedure.

Conclusion:

- The learning curve for hand-assisted retroperitoniscopic donor nephrectomy is short under the condition of sufficient previous experience in donor nephrectomy and laparoscopic surgery.

- Warm ischemia and blood loss reach a minimum after only 10 cases. Overall operative time improves over a longer period of time.

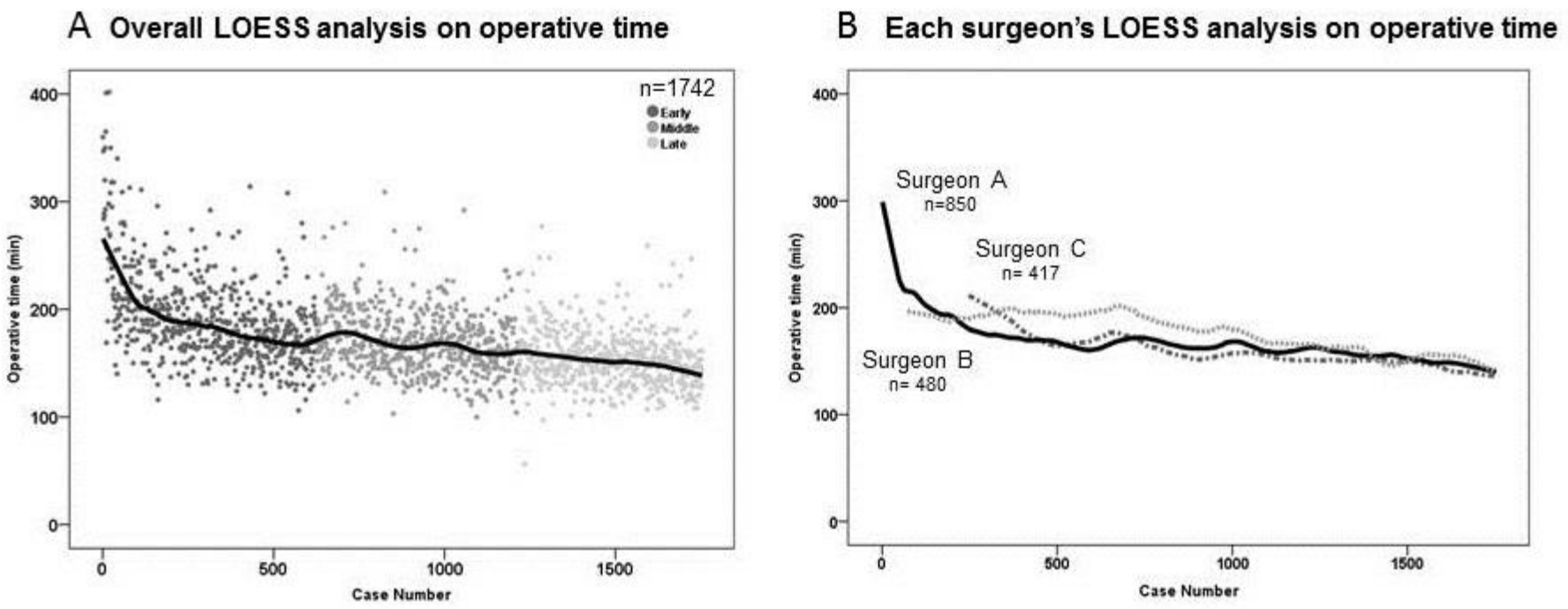
- There was no learning curve visible in the recipient renal function.

When Does the Learning Curve End? A High-Volume Single Center Experience with Laparoscopic Donor Nephrectomy Over 16 Years.

S. Yamanaga,[1,2,3] A. Posselt,[1] C. Freise,[1] C. Niemann,[1] A. Rosario,[1] D. Fernandez,[1] T. Kobayashi,[3] A. Ahearn,[4] M. Tavakol,[1] S.-M. Kang.[1]

ATC 2017, UCSF data

Figure 1.



Which surgical approach?

Laparoscopic experience

- Early: Hand assisted
- Established-expert: Laparoscopic / single port
- Robotic?

Proficiency in LD procedures

- Early:15-30 cases
- Established:30-100 cases
- Expert:>100 cases

Recommendations training in live donor nephrectomies

- Theory: Theoretical course / online
- Videos / elearning: still preliminary
- Cadaver course indispensible: LIDO course unique
- Fellowship in high volume centre or centre with high volume per surgeon
  - Training in phases (e.g. Ratner's mantra)
  - Assisting surgeon -> Step up operating surgeon
  - Experience: HARP technique safest and most easy to learn
  - Proctoring (in own centre) after fellowship

Unresolved issues:

- Should every Kidney Transplant Center do Live Donor Nephrectomies?
- How long is the learning curve?
- When is training finished/failed?
- What is the minimum number of LDN per surgeon to ensure safety?

Imperial College
Renal & Transplant
Centre

Thanks for your attention!

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