Surgical techniques for live donor nephrectomy in Europe

Frank J.M.F. Dor

Consultant Transplant Surgeon, Clinical Lead for Transplantation,

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

Dirk L. Stippel, Cologne, Germany

Disclosures

Sponsoring for Meeting Attendance from Astellas 2016
Sponsoring for Meeting Attendance from Chiesi 2020

Speaker Fees from Sandoz 2016, 2019
Speaker Fee from TEVA 2016
Speaker Fees from Astellas 2017,2018, 2019, 2020
Speaker Fee from Chiesi 2018, 2019

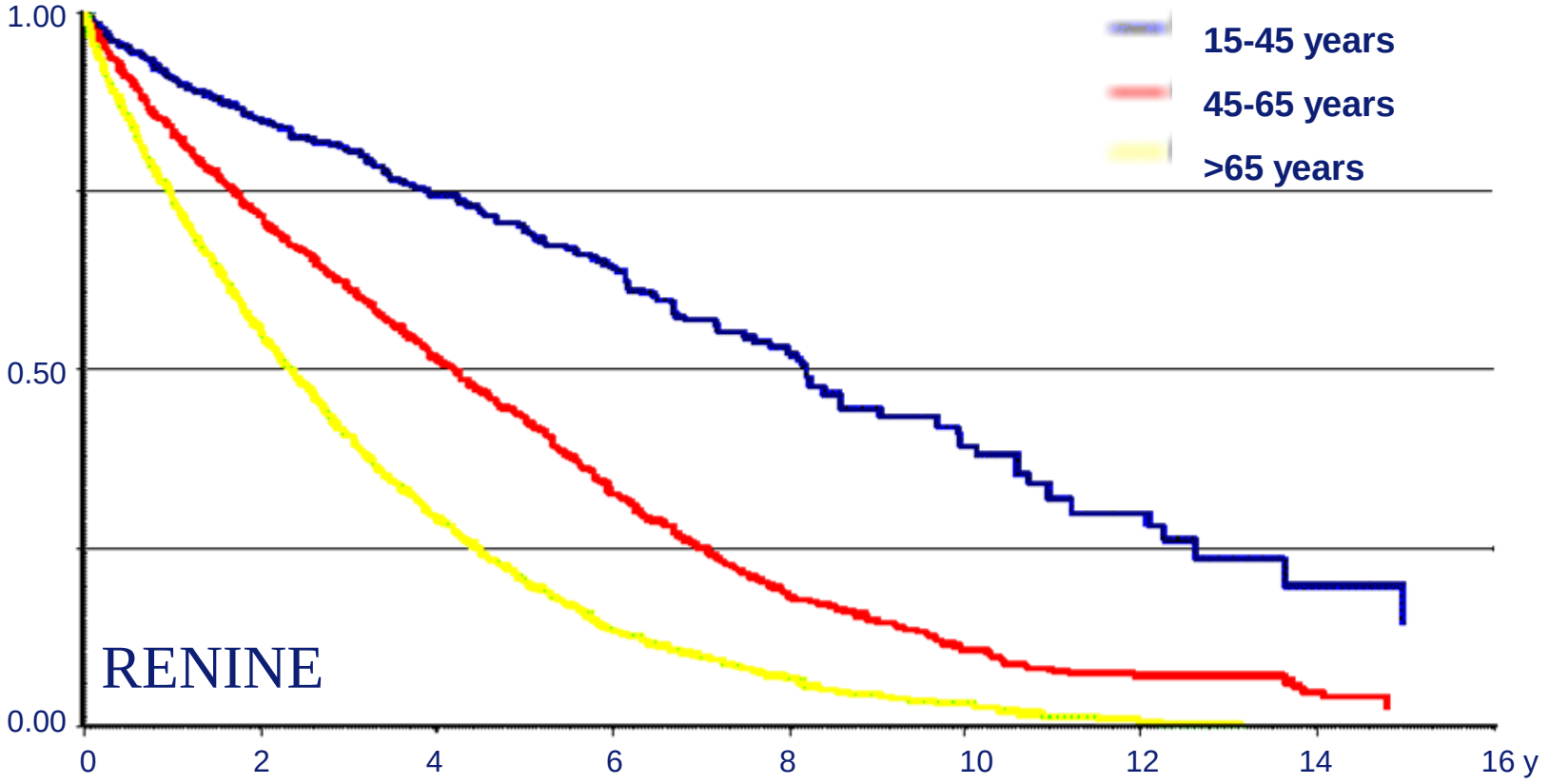
Consultant for Sandoz 2017, 2019, 2020

Scope of the Problem (Europe)

120.000	On dialysis
65.000	Waiting for a transplant
25.000	Transplanted per year
3-5 y	Wait time
5.500	Die on wait list per year
??	Removed from wait list
??	Not even on wait list

Courtesy of Willem Weimar

Survival on Dialysis



Advantages Live Kidney Donation

Elective surgery

Advantages for recipient:

- pre-emptive Tx: prevent dialysis
- alternative programs: paired exchange, unspecified, AB0i, HLAi
- selected donors -> good quality kidneys
- short cold ischemia -> superior graft function
-”impossible transplants"

Economic advantages

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 1:3000-1:8000
- Morbidity 2.3% (intra-op), 7.3% (post-op) Kortram et al. Transplantation 2016

Operation techniques-surgical revolution

- Original technique:

  1950: Flank incision (15-25 cm)

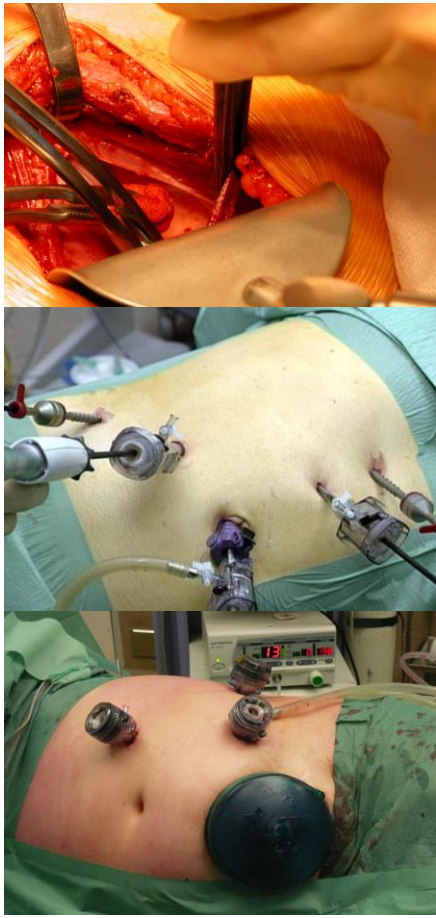
- Current techniques:


  1995: Laparoscopic donor nephrectomy

  1995: Mini-incision (7-15 cm)

  2002: Hand-assisted retroperitoneoscopic technique

  2009: Robot-assisted laparoscopic technique



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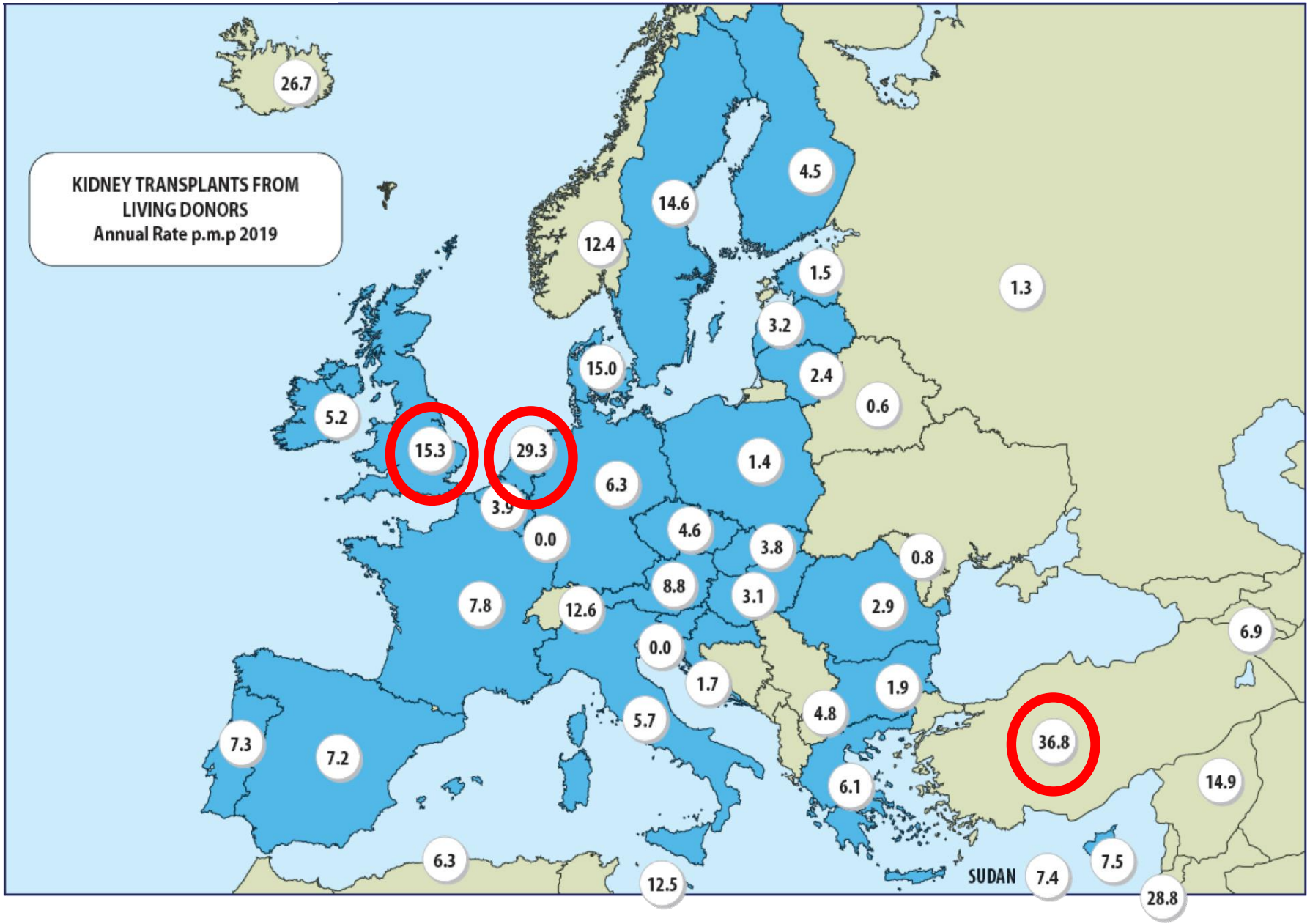

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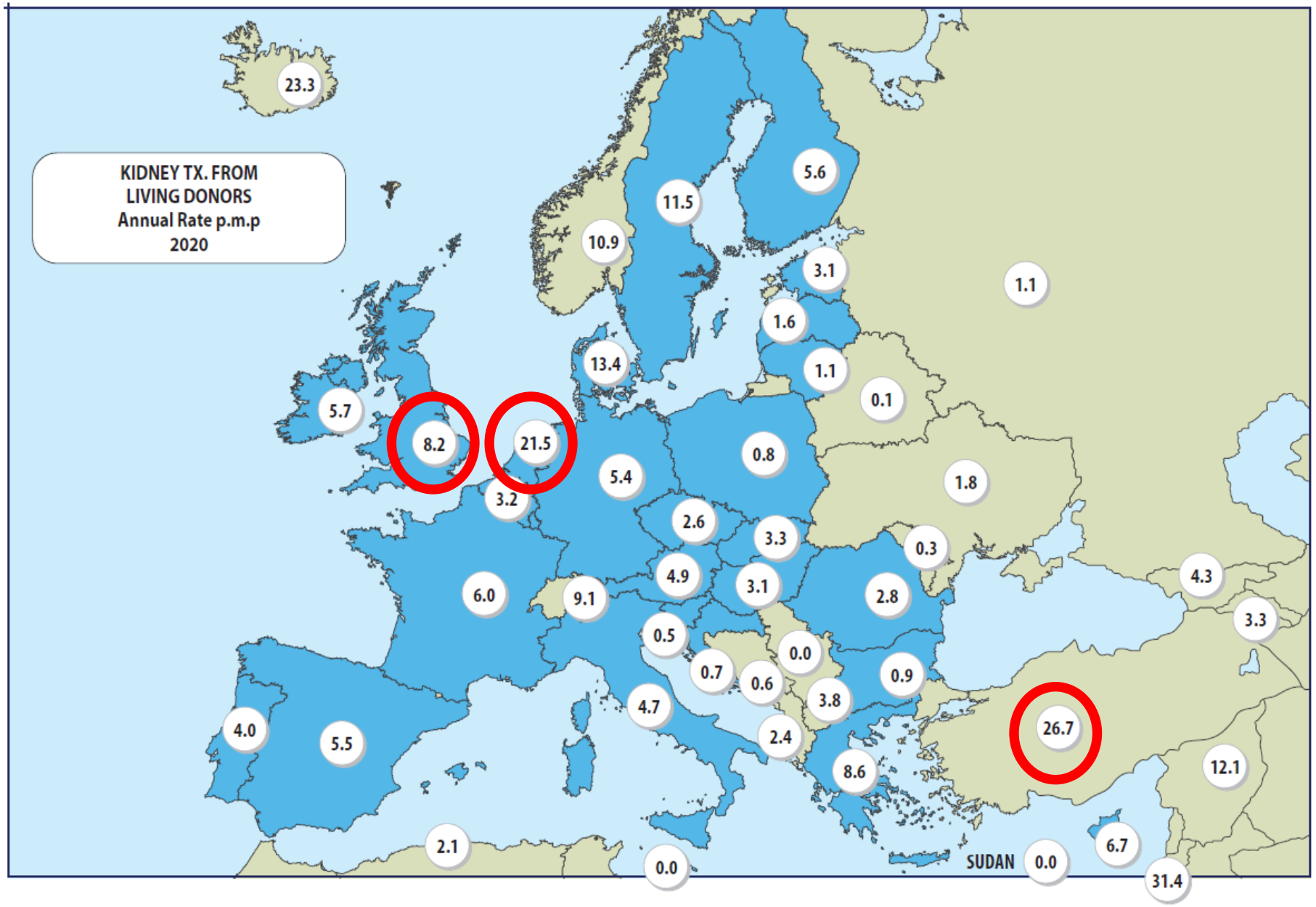


Live donor nephrectomy

1. There should be no technical barriers to living kidney donation

2. Training

3. Experience / centralisation / referral patterns

4. Tailor made donor nephrectomy

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

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]

Background. Minimally invasive live donor nephrectomy has become a fully implemented and accepted procedure. Donors have to be well educated about all risks and details during the informed consent process. For this to be successful, more information regarding short-term outcome is necessary. **Methods.** A literature search was performed; all studies discussing short-term complications after minimally invasive live donor nephrectomy were included. Outcomes evaluated were intraoperative and postoperative complications, conversions, operative and warm ischemia times, blood loss, length of hospital stay, pain score, convalescence, quality of life, and costs. **Results.** One hundred ninety articles were included in the systematic review, 41 in the meta-analysis. Conversion rate was 1.1%. Intraoperative complication rate was 2.3%, mainly bleeding (1.5%). Postoperative complications occurred in 7.3% of donors, including infectious complications (2.6%), of which mainly wound infection (1.6%) and bleeding (1.0%). Reported mortality rate was 0.01%. All minimally invasive techniques were comparable with regard to complication or conversion rate. **Conclusions.** The used techniques for minimally invasive live donor nephrectomy are safe and associated with low complication rates and minimal risk of mortality. These data may be helpful to develop a standardized, donor-tailored informed consent procedure for live donor nephrectomy.

(*Transplantation* 2016;00: 00–00)

Conversions, intra- and postoperative complications, reinterventions and mortality after minimally-invasive live donor nephrectomy

1. Conversion (ALL)	**1.1%**
-emergent (bleeding/organ injury)	0.7%
2. Intraoperative complications (ALL)	**2.2%**
-bleeding	1.5%
-injury other organs	0.8%
3. Postoperative complications (ALL)	**7.0%**
-bleeding (ALL)	1.0%
requiring transfusion	0.4%
-injury other organs (ALL)	0.09%
4. Infectious complications (ALL)	**2.6%**
-wound infections	1.6%
-UTI	0.4%
-pneumonia	0.6%

Conversions, intra- and postoperative complications, reinterventions and mortality after minimally-invasive live donor nephrectomy

5. Cardiopulmonary complications	
-pneumothorax	0.1%
6. Thromboembolic complications	0.2%
7. GI complications	
-ileus	0.7%
-small bowel obstruction	0.2%
8. other postoperative complications:	
a.fascial defect	0.2%
b.testicular swelling/pain/epididymitis	0.6%
c.Thigh numbness	0.3%
d.pain	0.8%
e.remnant kidney function disorder	0.3%
f.urinary retention	0.5%
g.drug reaction	0.5%
h. Other general complications	0.03%

Conversions, intra- and postoperative complications, reinterventions and mortality after minimally-invasive live donor nephrectomy

9. Mortality	**0.01%** (3:25116 donors): lower than reported 1:3000!
10. Surgical Reinterventions	**0.6%**

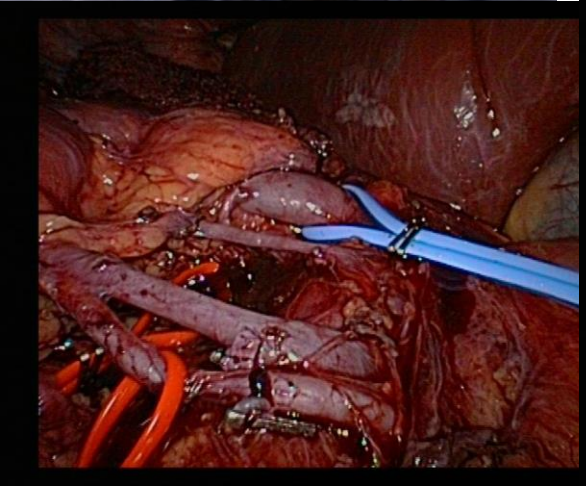
http://www.kidney-international.org review

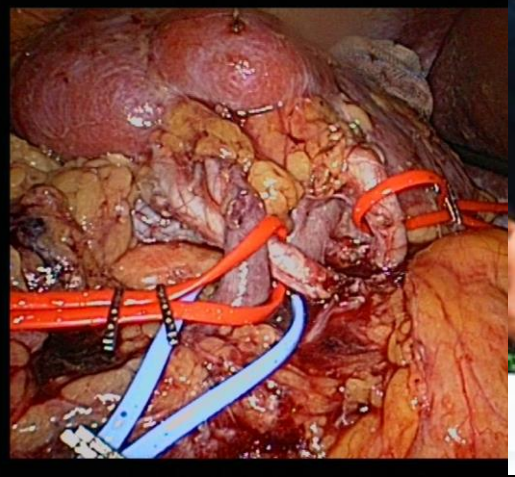
Shifting paradigms in eligibility criteria for live kidney donation: a systematic review

Ali R. Ahmadi[1,3], Jeffrey A. Lafranca[1,3], Laura A. Claessens[1], Raoul M.S. Imamdi[1], Jan N.M. IJzermans[1], Michiel G.H. Betjes[2] and Frank J.M.F. Dor[1]

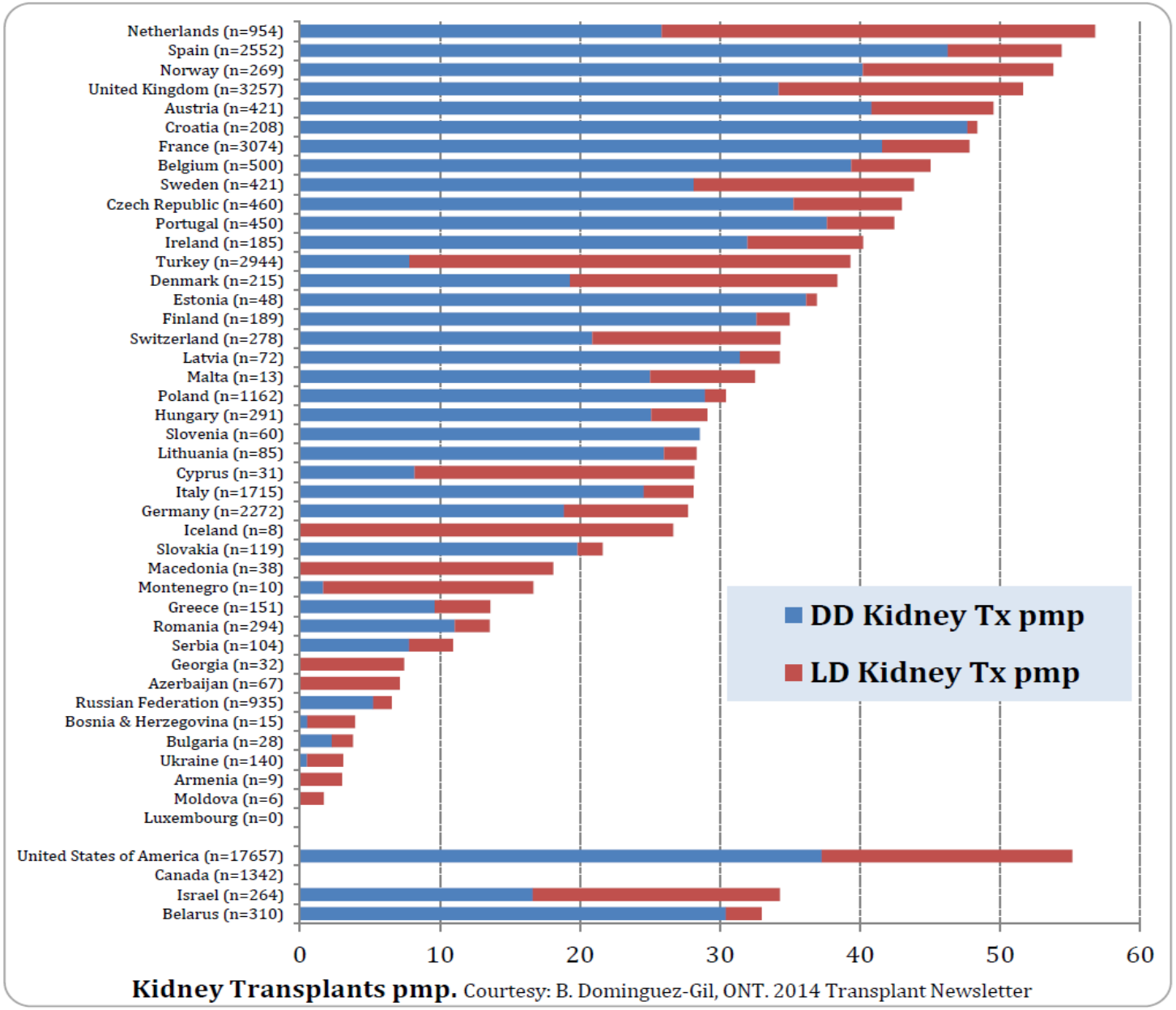
[1]Division of Transplant Surgery, Department of Surgery, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands and [2]Division of Nephrology, Department of Internal Medicine, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands

Extended Criteria Live Kidney Donors





Total transplants in European countries



Kidney Transplants pmp. Courtesy: B. Dominguez-Gil, ONT. 2014 Transplant Newsletter

DD: deceased donation

LD: Living donation

→ 24,082 kidney transplants for these 42 **CoE members** (30 % from living donors)

CoE observers

Living donation by center (Eurotransplant)

Kidney transplants (living donor), by year, by country, by transplant center

	Austria	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
A	AGATP	2	1	6	7	13	9	8	7	12	19
	AIBTP	29	20	11	9	9	10	11	17	13	13
	AOETP	9	15	16	20	15	16	15	11	15	12
	AOLTP			1	2	4					
	AWDTP									1	
	AWGTP	29	23	21	25	32	36	28	32	28	25
A	Total	69	59	55	63	73	71	62	67	69	69

	Belgium	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
B	BANTP	5	5	1	1	1	9	4	5	10	8
	BBJTP		1	2		1	1	2	3		2
	BBRTP	12	6	6	9	13	6	3	8	4	10
	BGETP	7	11	8	11	12	10	5	11	9	9
	BLATP	14	14	12	21	18	22	26	33	18	16
	BLETP	1					1	1	1	1	1
	BLGTP	5	5	2	4	3	5	8	2	3	1
	BLMTP	5	7	9	11	15	13	8	4	18	10
B	Total	49	49	40	57	63	67	57	67	63	57

	Germany	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
D	GAKTP	4	13	12	13	7	6	9	9	4	5
	GAUTP	1	2	8	3	5	7	5	9	6	6
	GBBTP	17	18	11	9	7	6	14	15	17	11
	GBCTP	50	54	64	86	77	62	64	60	69	67
	GBETP	4	6	14	14	10	8	4	11		
	GBMTP	8	10	7	6	10	7	5	5	2	2
	GBOTP	5	6	3	2	10	8	4	1	3	2
	GDRTP	8	10	21	15	16	21	17	17	15	11
	GDUTP	28	26	25	28	27	18	24	14	17	23
	GESTP	30	26	44	29	22	18	36	18	24	21
	GFDTP	1	3	2	3	3	6	7	6	3	11
	GFMTP	13	15	11	20	21	11	13	19	20	18
	GFRTP	35	35	35	36	35	37	33	30	26	33
	GGITP	16	16	15	16	11	12	14	15	7	13
	GGOTP			1							
	GHATP	8	9	9	11	13	14	14	9	11	12
	GHBTP	57	53	65	57	54	27	31	30	20	29
	GHGTP	22	28	29	21	26	22	21	23	14	25
	GHMTP	12	15	21	26	21	11	12	11	7	15
	GHOTP	50	54	59	44	43	33	47	30	29	29

	Germany	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
D	GHSTP		4	10	5	7	4	3	5	7	6
	GJETP	5	5	7	6	7	4	8	3	6	8
	GKITP	12	8	9	6	6	8	7	7	5	11
	GKKTP	1	3	7	4	3	2	5	6	6	5
	GKLTP	19	30	25	28	23	30	23	24	24	36
	GKMTP	6	14	18	24	14	9	15	20	17	22
	GKSTP	12	12	14	10	5	4	3	7	8	9
	GLPTP	6	6	11	8	6	5	6	5	9	16
	GLUTP	22	14	21	18	18	17	16	21	15	12
	GMATP	9	8	4	9	9	4	12	6	8	8
	GMHTP	16	20	20	15	14	21	20	15	20	20
	GMLTP	18	37	38	39	41	31	27	30	22	31
	GMNTP	22	21	33	27	44	38	37	20	29	33
	GMRTP	7	6	8	9	10	2	4	6	7	6
	GMZTP	1		3	1	6	3	4	1	6	8
	GNBTP	22	12	29	28	25	21	18	26	12	14
	GRBTP	11	21	8	20	13	20	14	14	16	9
	GROTP	5	6	8	2	7	5	2	3	3	2
	GSTTP	22	19	29	34	29	29	15	23	21	25
	GTUTP	10	9	16	23	18	18	22	18	12	13
	GULTP	2	5	2							
	GWZTP	3	6	19	11	2	10	10	5	10	11
D	Total	600	665	795	766	725	619	645	597	557	638

	Hungary	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
H	HBSTP					17	31	20	19	29	30
	HDBTP						5	5	3	1	1
	HPCTP						4	7	8	4	6
	HSZTP					2	6	8	4	6	8
H	Total					19	46	40	34	40	45

	Croatia	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
HR	CRITP		1				1			1	
	CZATP	3	8	3	5	1	4	2	3	1	2
	CZMTP	11	11	6	4	2	6	3	4	9	3
HR	Total	14	20	9	9	3	11	5	7	11	5

	Netherlands	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NL	NAETP					3	2	3	5	6	1
	NAVTP	23	26	23	22	21	32	36	29	31	30
	NAWTP	41	50	38	41	66	65	57	57	48	62
	NGRTP	64	61	58	63	76	72	91	116	105	91

	Netherlands	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NL	NLBTP	60	75	64	68	81	77	68	69	61	72
	NMSTP	24	30	33	29	31	29	25	31	37	28
	NNYTP	55	75	66	77	74	84	85	91	105	79
	NRDTP	115	123	124	145	136	131	112	124	122	108
	NRSTP	5	8	6	7	5	8	5	5	8	7
	NUTTP	27	24	28	33	27	34	32	37	29	32
	NUWTP	3	1								
NL	Total	417	473	440	485	520	534	514	564	552	510

	Slovenia	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SLO	SLOTP	1							2	2	2
SLO	Total	1							2	2	2

	Non-ET	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Non-ET	OTHTP		1		1						
Non-ET	Total		1		1						

	All ET	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
All ET	Total	1150	1267	1339	1381	1403	1348	1323	1338	1294	1326

statistics.eurotransplant.org : 2006M_kidney : 22.01.2019 : counting recipient transplants

Living donation – surgical technique - survey 2004 versus 2009

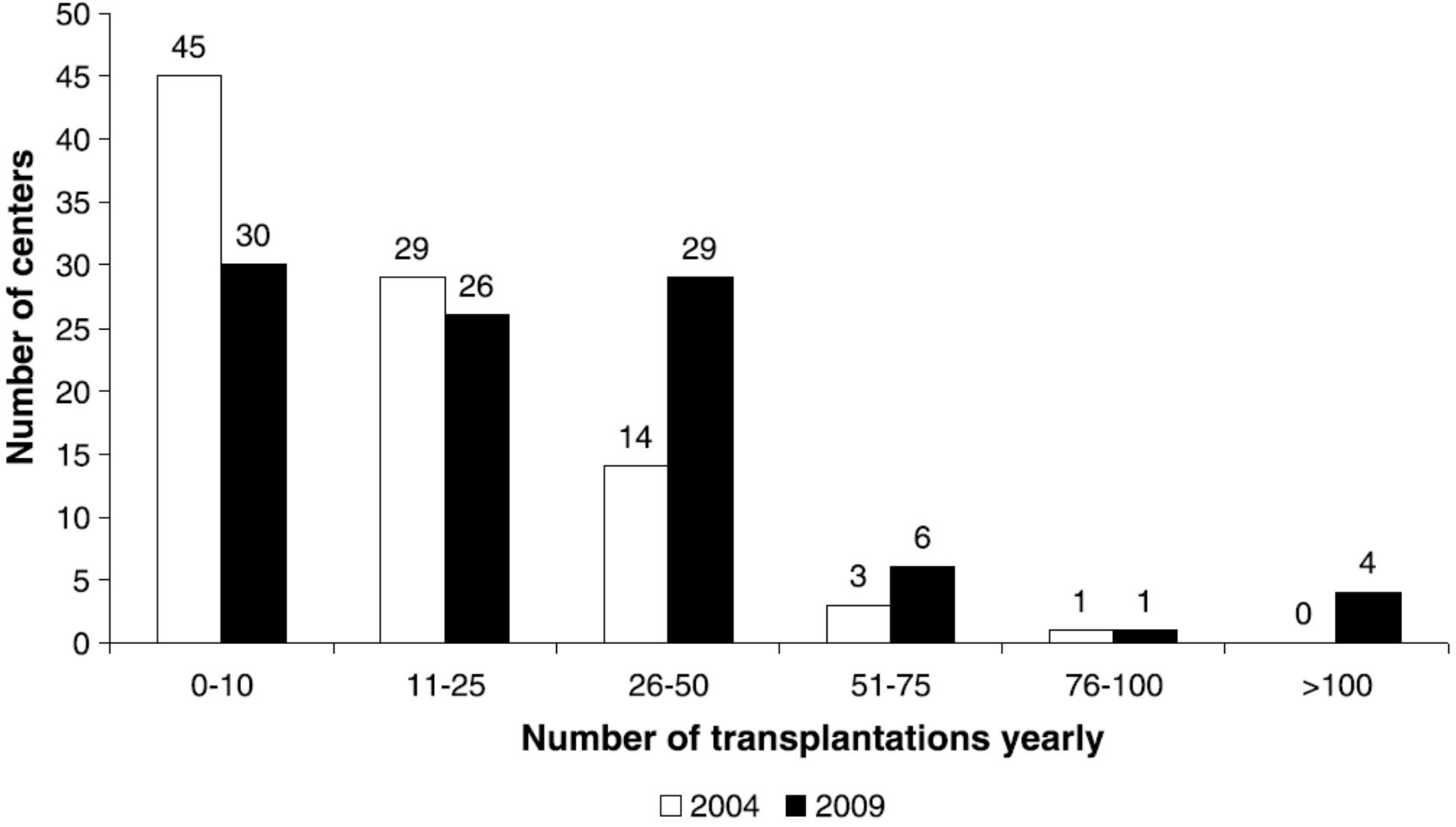
- 96 of 119 centers replied
- data collection by survey
- Items: number of living donAtions, surgical technique, donor comorbidities

Attitudes Among Surgeons Towards Live-Donor Nephrectomy: A European Update

Karel W.J. Klop,[1] Leonienke F.C. Dols,[1] Niels F.M. Kok,[1] Willem Weimar,[2] and Jan N.M. IJzermans[1,3]

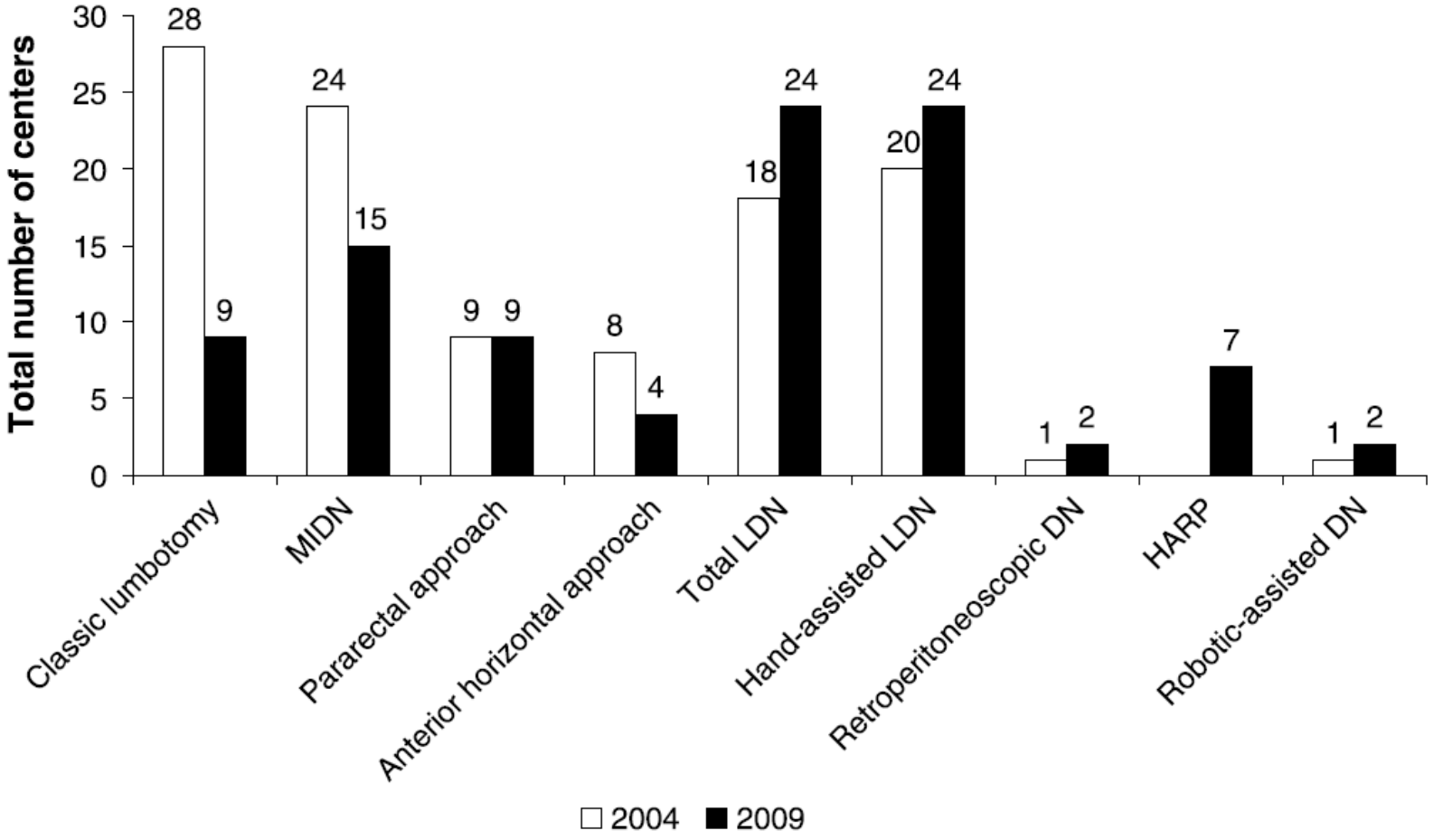
(*Transplantation* 2012;94: 263–268)

Living donation – surgical technique - survey 2004 versus 2009



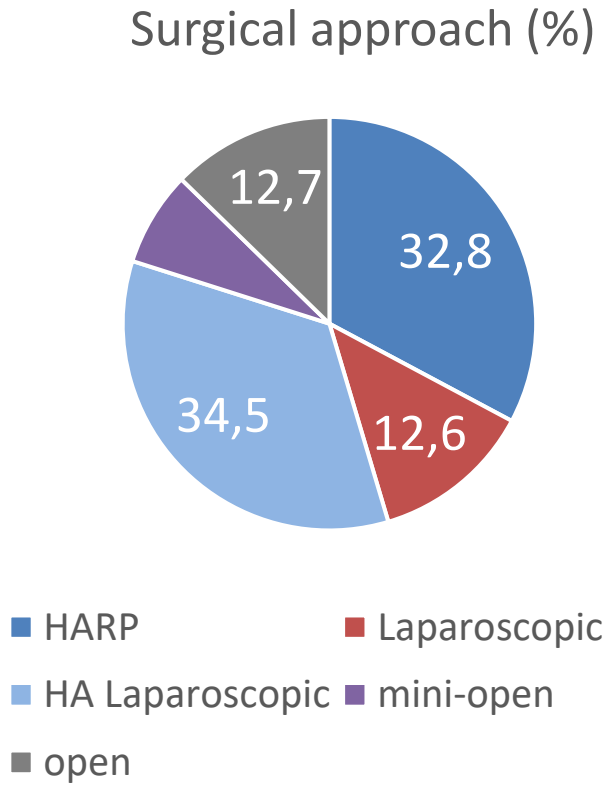
Klop K, Transplantation 2012

Living donation – surgical technique - survey 2004 versus 2009



Klop K, Transplantation 2012

Swiss Experience – SOL-DHR Registry (registry of all living donations) - Living donation 1998 - 2015 (n=1694)

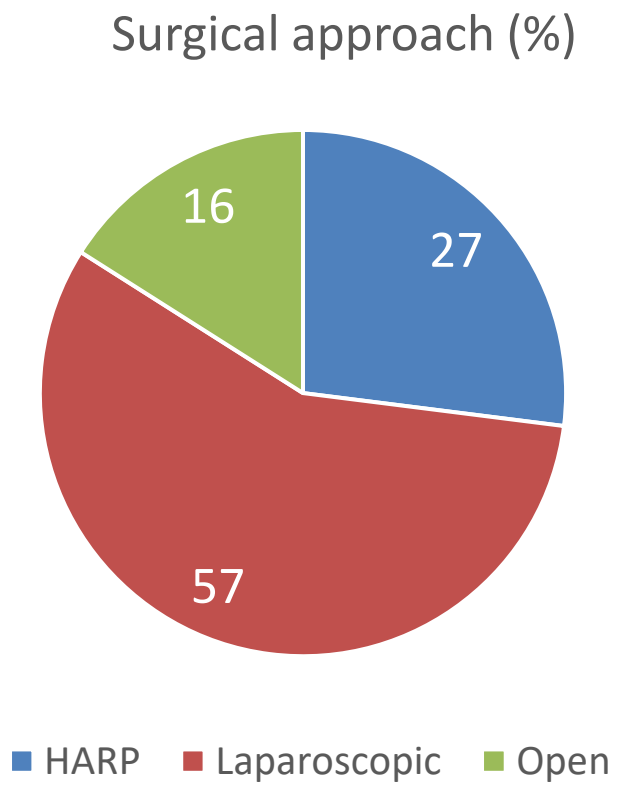


Conversion rate:
HARP 0,3%
Laparoscopic 3,3%
HA Laparoscopic 0,2%

Dindo Clavien III 2,1%

Burghalter F, Swiss Med Wkly 2017

German Experience – Solkid Registry (registry of all living donations) - Living donation 2020 (n=450)



Conversion rate:
HARP 1%
Laparoscopic 13%

Dindo Clavien III 2,3%

Injury to the organ
vessel injury 6,3%
Ureter injury 1,8%
(both predominatly in open approach)

unpublished provisional data, to be published at DTG 2022

TRANSPLANT
INTERNATIONAL

Transplant International ISSN 0934-0874

ORIGINAL ARTICLE

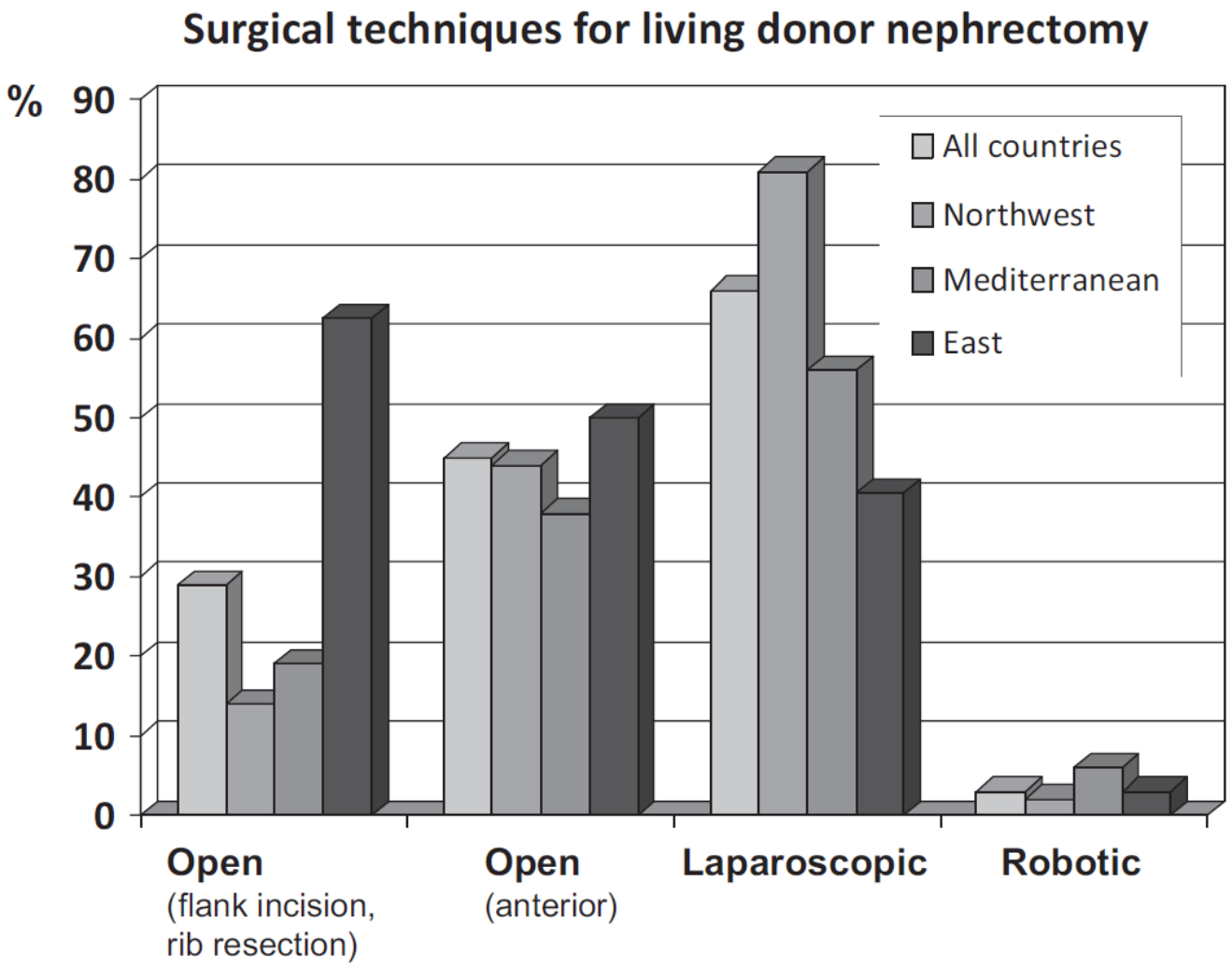
Living organ donation practices in Europe – results from an online survey

Annette Lennerling,[1] Charlotte Lovén,[1] Frank JMF Dor,[2] Frederike Ambagtsheer,[3] Nathalie Duerinckx,[4] Mihaela Frunza,[5] Assya Pascalev,[6] Willij Zuidema,[3] Willem Weimar[3] and Fabienne Dobbels[4]

1 Institute of Health and Care Sciences, University of Gothenburg, Gothenburg, Sweden
2 Division of Transplant Surgery, Department of Surgery, Erasmus MC, University Medical Center, Rotterdam, The Netherlands
3 Department of Internal Medicine, Erasmus MC, University Medical Center, Rotterdam, The Netherlands
4 Centre for Health Services and Nursing Research, Katholieke Universiteit Leuven, Leuven, Belgium
5 Department of Philosophy, Babes-Bolyai University, Cluj, Romania
6 Bulgarian Center for Bioethics, Sofia, Bulgaria

Living donation – surgical technique (EULOD 2011)

- 109 centers replied performing living kidney donation
- Center size < 25 / year: northwest 45%, mediterrean 73%, east 81%



Lennerling, A Transplant Int 2012

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Renal & Transplant
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PLOS ONE

RESEARCH ARTICLE

Attitudes among transplant professionals regarding shifting paradigms in eligibility criteria for live kidney donation

Jeffrey A. Lafranca[1], Emerentia Q. W. Spoon[1], Jacqueline van de Wetering[2], Jan N. M. IJzermans[1], Frank J. M. F. Dor[1¤]*

1 Department of Surgery, division of HPB and Transplant Surgery, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands, **2** Department of Internal Medicine, division of Nephrology, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands

¤ Current address: Imperial College Renal and Transplant Centre, Hammersmith Hospital, Imperial College, London, United Kingdom
* frank.dor@imperial.nhs.uk

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Renal & Transplant
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PLOS ONE

RESEARCH ARTICLE

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1 Department of Surgery, division of HPB and Transplant Surgery, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands, 2 Department of Internal Medicine, division of Nephrology, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands

¤ Current address: Imperial College Renal and Transplant Centre, Hammersmith Hospital, Imperial College, London, United Kingdom
* frank.dor@imperial.nhs.uk

- Big differences in surgical technique in various parts of Europe (up to 33% in East-Europe open DN)
- Different appetite for risk/extended criteria donors in various European regions
- Centre volume:
  - Bigger centres in NW Europe
  - More advanced surgical techniques incl robotics
  - More extended criteria donors

American Journal of Transplantation 2015; 15: 2791–2792
Wiley Periodicals Inc.

doi: 10.1111/ajt.13484

Editorial

Surgical Technique in Transplantation: How Much Does It Matter?

S. J. Knechtle* and D. L. Sudan

DONORS SELF-REPORTED EXPERIENCES OF LIVE KIDNEY DONATION—A PROSPECTIVE STUDY

Annette Lennerling[1,2], RN, PhD, Anna Forsberg[1,3], RN, PhD
[1]Transplant Institute, Sahlgrenska University Hospital, Gothenburg, Sweden
[2]Institute of Health and Care Sciences, The Sahlgrenska Academy, University of Gothenburg, Sweden
[3]Department of Health Sciences, Lund University, Lund, Sweden

Lennerling A., Forsberg A. (2012). Donors self-reported experiences of live kidney donation—A prospective study. *Journal of Renal Care* **38**(4), 207-212.

Transplantation Proceedings, 37, 2011–2015 (2005)

DONOR AND RECIPIENT PROCEDURES

Laparoscopic versus Open Donor Nephrectomy in Germany: Impact on Donor Health-Related Quality of Life and Willingness to Donate

M Giessing, S Reuter, S Deger, M Tüllmann, I Hirte, K Budde, L Fritsche, T Slowinski, D Dragun, H.H. Neumayer, S.A. Loening, and B. Schönberger

DONORS SELF-REPORTED EXPERIENCES OF LIVE KIDNEY DONATION—A PROSPECTIVE STUDY

Annette Lennerling[1,2], RN, PhD, Anna Forsberg[1,3], RN, PhD
[1]Transplant Institute, Sahlgrenska University Hospital, Gothenburg, Sweden
[2]Institute of Health and Care Sciences, The Sahlgrenska Academy, University of Gothenburg, Sweden
[3]Department of Health Sciences, Lund University, Lund, Sweden

Lennerling A., Forsberg A. (2012). Donors self-reported experiences of live kidney donation—A prospective study. *Journal of Renal Care* 38(4), 207-212.

"Our experience from hundreds of LDs, confirms that the transition from a completely healthy person before donation to a person with a recognised illness afterwards applies also to them."

From a clinical perspective, there seems to be a gap between the donors' inside perspective and the professionals outside perspective regarding what to expect after LKD and the recovery process."

Criteria from a donor‘s point of view

- cosmetics
- perioperative pain
- time period until re-uptake of normal live activities

Chung E BJU 2008

Journal of
Clinical Medicine

MDPI

Article

Living Kidney Donor Knowledge of Provided Information and Informed Consent: The PRINCE Study †

Emerentia Q. W. Spoon [1], Kirsten Kortram [1], Sohal Y. Ismail [2], Daan Nieboer [3], Frank C. H. d'Ancona [4], Maarten H. L. Christiaans [5], Ruth E. Dam [6], Hendrik Sijbrand Hofker [7], Arjan W. J. Hoksbergen [8], Karlijn Ami van der Pant [9,10], Raechel J. Toorop [11], Jacqueline van de Wetering [12], Jan N. M. Ijzermans [1], Frank J. M. F. Dor [1,13,*,‡] and on behalf of the Dutch Working Group Informed Consent for Live Donor Nephrectomy ("PRINCE") [§]

Table 3. Pop-quiz scores and item scores for donors included in the two cohorts (mean, SD). The maximum overall score is 25 points, 5 points for each score item.

	Cohort A $n = 417$	Cohort B $n = 239$	p-Value
Overall Score	7.0 (3.9)	10.5 (2.8)	<0.0001
Convalescence [a]	2.9 (1.6)	3.4 (1.3)	<0.0001
Admission [a]	2.6 (1.7)	3.6 (0.9)	<0.0001
Surgical technique [a]	0.7 (1.0)	2.2 (1.2)	<0.0001
Short-term complications [a]	0.7 (0.8)	1.0 (0.9)	<0.0001
Long-term complications [a]	0.2 (0.4)	0.2 (0.4)	0.91

[a] For the item scores, the 40 overlapping donors were excluded from the analysis, and the p-values were calculated using the independent samples t-test. The subscores are thus calculated for 373, versus 199, donors.

Table 4. Frequencies of the individual complications mentioned, per cohort. Percentages between brackets.

	Cohort A $n = 417$	Cohort B $n = 239$	p-Value
Short-term complications			
Fatigue	141 (33.8)	103 (43.1)	0.2
Pain	80 (19.2)	72 (30.1)	0.02
Infection (NOS)	70 (16.8)	54 (22.6)	0.3
Wound infection	66 (15.8)	71 (29.7)	0.001
Bleeding	51 (12.2)	74 (31.0)	0.03
Thrombosis	39 (9.4)	33 (13.8)	0.08
Pneumonia	36 (8.6)	35 (14.6)	0.23
Urinary tract infection	26 (6.2)	35 (14.6)	<0.0001
Death	21 (5.0)	32 (13.4)	0.57
Damage to other organs	3 (0.7)	1 (0.4)	0.93
Neuropathy/neurapraxia	3 (0.7)	6 (2.5)	0.11
Cardiovascular complications	2 (0.5)	2 (0.8)	0.66
Testicular complaints [a,b]	0	3 (1.3)	0.8
Long-term complications			
ESKD	66 (15.8)	35 (14.6)	0.87
Chronic pain	11 (2.6)	6 (2.5)	0.74
Hypertension	11 (2.6)	13 (5.4)	0.13
Incisional hernia	4 (1.0)	4 (1.7)	<0.0001
Medication (NSAIDs, AB)	1 (0.2)	3 (1.3)	0.18

NOS: not otherwise specified; ESKD: end-stage kidney disease; NSAIDs: nonsteroidal anti-inflammatory drugs; AB: antibiotics; NA: not applicable. [a] Since testicular complaints are a relevant complication only in male donors, the relevant percentage is 2.7% (3 out of 110 males in Cohort B), instead of 1.3% for the whole group of 226 donors. [b] Because none of the Cohort A donors reported this complication, a p-value could not be computed using the generalized linear model.

Incision-related outcomes after LDN

Surg Endosc
DOI 10.1007/s00464-013-2811-0

SURGICAL ENDOSCOPY and Other Interventional Techniques

Incision-related outcome after live donor nephrectomy: a single-center experience

Karel W. J. Klop · Farah Hussain · Oguzhan Karatepe · Niels F. M. Kok · Jan N. M. IJzermans · Frank J. M. F. Dor

Incision-related outcomes after LDN

Incisional hernia: 1.5%

Cosmesis and Body Image:

Surg Endosc

Table 4 Results of the uni- and multivariate analysis regarding the cosmesis scale

Characteristic	Univariate		Multivariate	
	OR (95 % CI)	*p*	OR (95 % CI)	*p*
Sex	1.35 (0.96–1.89)	0.088	1.37 (0.97–1.95)	0.08
Age ≤60 years	1.03 (1.02–1.05)	<0.001	1.03 (1.02–1.05)	<0.001
BMI after donation	0.97 (1.17–4.42)	0.22		
Graft survival	1.24 (0.59–2.57)	0.57		
Recipient survival	1.81 (0.35–3.61)	0.095	2.10 (1.03–4.26)	0.041
Absence of incisional hernia	3.88 (0.91–16.59)	0.067	4.45 (1.02–19.39)	0.046

OR odds ratio, *CI* confidence interval, *BMI* body mass index

Scientific background - Cochrane Systematic Review

- Laparoscopic versus open
  - 6 randomized studies
  - Minimal-invasive approach less pain, faster recovery
  - No difference in complications, kidney function
- LESS versus laparoscopic
  - Unclear data
  - More conversions
  - More complications
  - Tendency to less pain
- Robotics versus laparoscopic
  - No data

Wilson CH, Cochrans Syst Data Rev 2011, Autorino R, BJU Int 2015

Comparison between techniques

Characteristics of the study participants	Open surgery ($n=65$)	Hand-assisted laparoscopy ($n=65$)	Standard laparoscopy ($n=65$)	Robot-assisted laparoscopy ($n=69$)	*P*-value
Operative time (min), mean	182.8	157.5	173.6	202.7	<0.0001
Length of hospital stay (days)					0.0023
Mean	7.5	6.2	6.2	6.3	
Median	7	6	6	6	
Min-max	4–15	3–12	4–11	3–29	
Percentage of right kidney	24.6	16.9	3.1	15.9	0.0071
Analgesic consumption (mg), mean	278.9	162.6	328.1	111.4	0.31
Costs of materials					
Disposable instrument cost	**532.4** (126.9–2054.3)	**538.4** (443.5–738.7)	**611.6** (402–1127.4)	**1056.1** (644–1673.6)	**<0.0001**
Sterilization cost	**52.8** (52.8–52.8)	**80.8** (79.2–109)	**79.2** (79.2–79.2)	**109** (109–109)	**<0.0001**
Staff costs	**1899.7** (1236.1–2788.6)	**1427.2** (1402.1–1452.3)	**1572.9** (1095.9–2109.5)	**2115.4** (1323.1–3495.6)	**<0.0001**
Complication costs	**29.7**	**9.9**	**168.3**	**149.2**	**<0.0001**
Total cost	**2514.6** (2186.6–2786.5)	**2056.4** (2019.5–2093.4)	**2432** (2241.5–2622.5)	**3429.8** (2904.6–3955)	**<0.0001**

Complications severity	Total		Open surgery		Hand-assisted laparoscopy		Standard laparoscopy		Robot-assisted surgery		*P*-value
	n	%	*n*	%	*n*	%	*N*	%	*n*	%	
Clavien I	91	32.4	15	23.4	46	60.5	19	27.9	11	15.1	0.0001
Clavien II	13	4.6	3	4.7	0	0	4	5.9	6	8.2	0.11
Clavien IVb	1	0.4	1	1.6	0	0	0	0	0	0	0.33

Achit H Nephrol Dial Transplant (2020), France

Advantages minimally invasive approach? From existing RCTs

- Advantages minimally invasive
  - less need for pain medication
  - shorter hospital stay
  - shorter interval untill return to normal activities

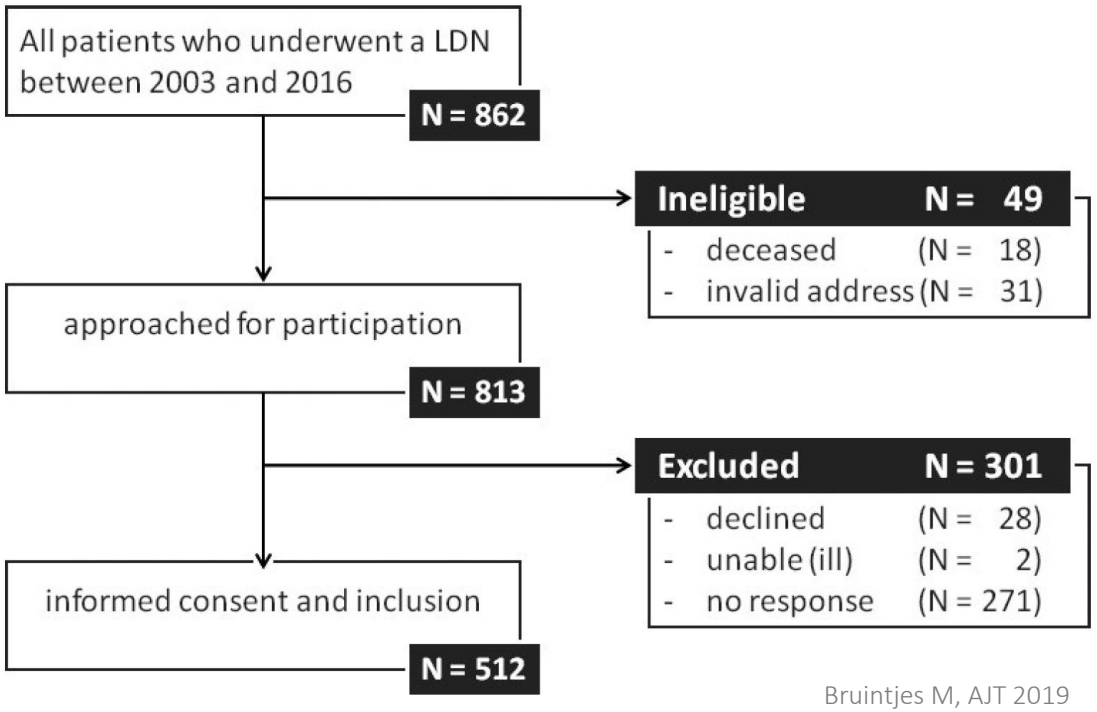
- Advantages open approach
  - shorter skin to skin time
  - shorter warm ischemia

THE COCHRANE COLLABORATION®

Wilson CH Laparoscopic versus open nephrectomy for live kidney donors 2011

Chronic pain after living donation – prevalence and impact on quality of life

- a cross-sectional study
- Radboud University Medical Center Nijmegen 2003-2016



Bruintjes M, AJT 2019

Chronic pain after living donation – prevalence and impact on quality of life

- a cross-sectional study
- Radboud University Medical Center Nijmegen 2003-2016

RAND SF-36 subscales (%)	Whole group n = 512	Patients with pain n = 29	Patients without pain n = 483	*P*-value
Physical functioning	91.0 ± 15.4	80.7 ± 18.9	91.6 ± 14.9	.005
Role limitations due to physical health problems	87.9 ± 29.8	57.1 ± 47.1	89.7 ± 27.5	.001
Role limitations due to personal or emotional problems	93.6 ± 22.2	80.5 ± 38.3	94.4 ± 20.6	.063
Energy/fatigue	70.0 ± 19.2	52.8 ± 19.7	71.1 ± 18.7	<.001
General mental health	81.9 ± 14.2	71.4 ± 16.9	82.6 ± 13.8	.002
Social functioning	92.5 ± 16.1	83.6 ± 23.4	93.0 ± 15.4	.041
Bodily pain	90.9 ± 17.0	72.1 ± 21.6	92.1 ± 16.0	<.001
General health perceptions	76.0 ± 18.6	63.2 ± 21.1	76.7 ± 18.1	<.001

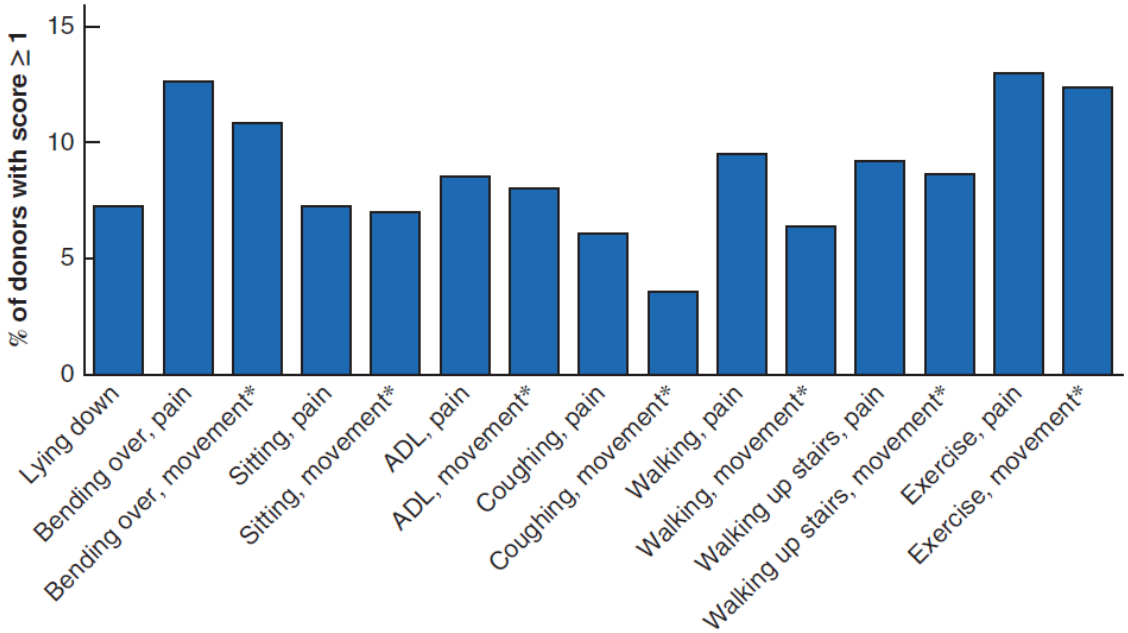
Bruintjes M, AJT 2019

Chronic pain after hand-assisted laparoscopic donor nephrectomy

BJS 2019; **106**: 711–719

M. Zorgdrager[1], M. van Londen[2], L. B. Westenberg[1], G. J. Nieuwenhuijs-Moeke[3], J. F. M. Lange[4], M. H. de Borst[2], S. J. L. Bakker[2], H. G. D. Leuvenink[4] and R. A. Pol[4]

Carolinas Comfort Scale subcategory scores of living kidney donors



Learning curve for laparoscopic living donation (HA-LLDN)

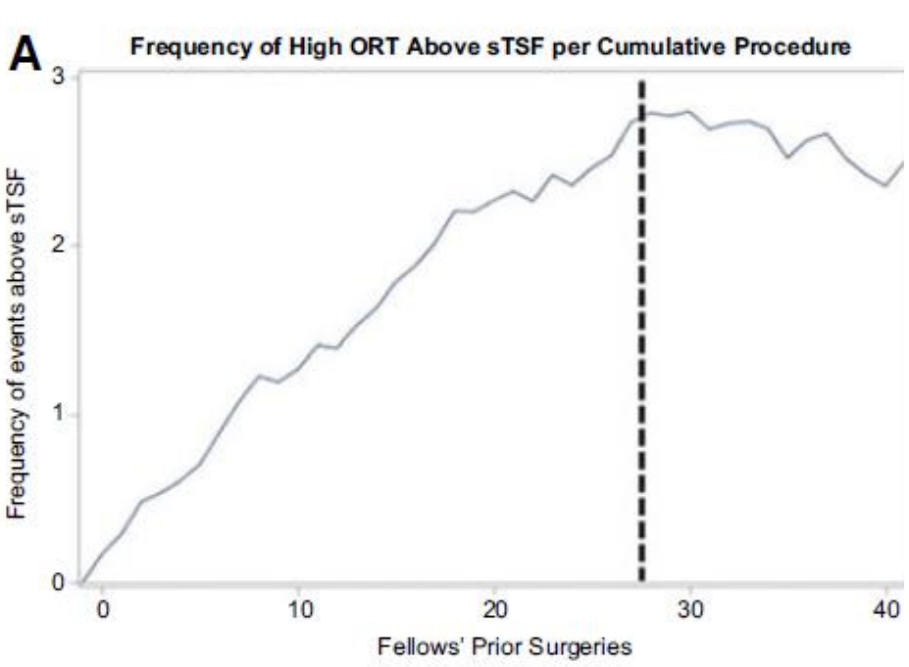
Defining the Tipping Point in Surgical Performance for Laparoscopic Donor Nephrectomy Among Transplant Surgery Fellows: A Risk-Adjusted Cumulative Summation Learning Curve Analysis

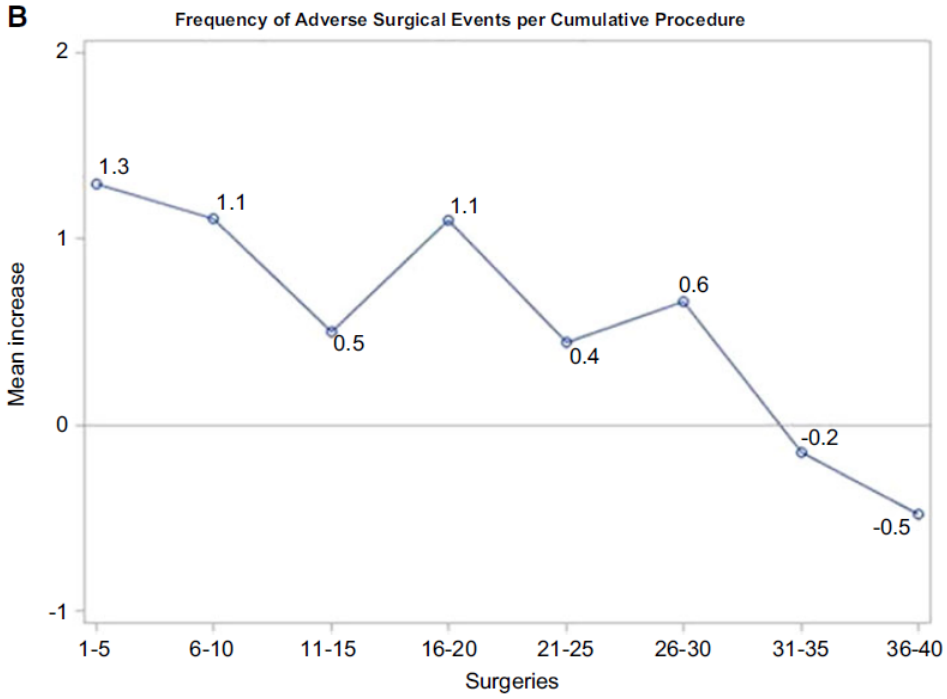
O. K. Serrano[1]*, A. S. Bangdiwala[2], D. M. Vock[3], D. Berglund[1], T. B. Dunn[1], E. B. Finger[1], T. L. Pruett[1], A. J. Matas[1] and R. Kandaswamy[1]

- University of Minnesota performing 300 living donations / year
- Standardized training program for surgical fellows (6 Months, 50 LLDN)

Serrano O, AJT 2017

Learning curve for laparoscopic LDN HA-LLDN





Serrano O, AJT 2017

How many cases needed to start a laparoscopic program

Laparoscopic live donor nephrectomy: Are ten cases per year enough to reach the quality standards? A report from a single small-volume transplant center

Surg Endosc (2010) 24:594–600
DOI 10.1007/s00464-009-0642-9

S. Saad · A. Paul · J. Treckmann · A. Tarabichi · M. Nagelschmidt · W. Arns

- Depending on the personal experience of the surgeon in two fields
  - ✓ Laparoscopic surgery
  - ✓ Donor nephrectomies
- Depending on the support for the change of method:
  - ✓ LiDo course
  - ✓ Visit to centers
  - ✓ Proctoring of the first cases

International Journal of Surgery
Volume 86, February 2021, Pages 7-12

Retrospective Cohort Study

Learning curves of minimally invasive donor nephrectomy in a high-volume center: A cohort study of 1895 consecutive living donors

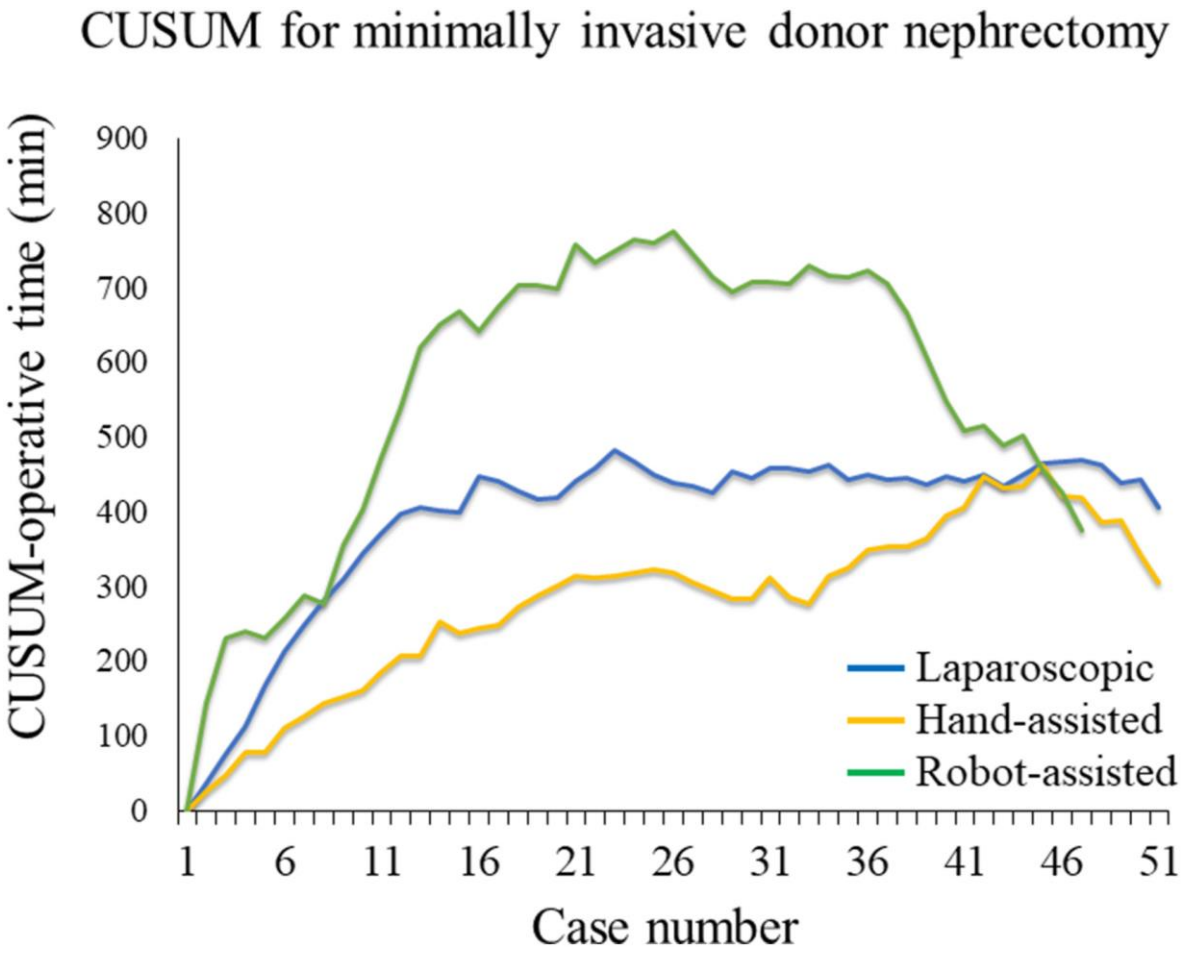
Kosei Takagi [a, b], Hendrikus J.A.N. Kimenai [a], Turkan Terkivatan [a], Khe T.C. Tran [a], Jan N.M. Ijzermans [a], Robert C. Minnee [a]

Learning curves of LDN, HARP, and RADN using the CUSUM analysis.

Lapsc: 23

HARP: 45

RADN: 26



Training:Hands on Live Donor Nephrectomy Course (LIDO COURSE)

LIDO COURSE

since 2009, participants from:

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

LIDO COURSE

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

LIDO COURSE

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

- Training done by 2 consultant transplant surgeons
- Tailor-made approach to trainee (consultant, fellow) based on previous experience, in different techniques
- Simulation training for all theatre staff

Ratner's Mantra

Meticulous attention to technical detail

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

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

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

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

Conclusions I:

- ✓Large number of small centers in Europe (only 1 centers > 100 / year in 2018)
- ✓“old fashioned” open technique (flank incision) still existing
- ✓Strong tendency to minimal-invasive techniques
- ✓To perform laparoscopic technique 10-20 cases might be enough
- ✓To teach laparoscopic techniques > 30 cases needed

Conclusions II:

- sparse data on influence of surgical procedure on psychosocial outcome
  - **short term data**
  - **only selected procedure variants**
- donors need
  - **a pain “free” procedure**
  - **low percentage of complications**
  - **no permanent damage of muscle or nerves**

Thanks for your attention!

Frank.Dor@nhs.net

@frank_dor