The UK Living Kidney Sharing Scheme

Rachel Johnson and Lisa Burnapp
NHS Blood and Transplant
Outline

Rachel:

- Introduction
- Development of the current UK exchange scheme
- Current activity

Lisa:

- Operational aspects of the scheme
- Challenges and opportunities
- Summary
Introduction
Living donor kidney transplant rates for Europe, Australia and the USA, 2015

Source: Council of Europe – Transplant Newsletter
Living kidney donation
Potential Donor-Recipient pair

• Blood group incompatibility
• Positive crossmatch

Approx 20-30% of possible living donor transplants
Background

- September 2006
  Change in legal framework
  Development of national scheme including matching algorithm

- April 2007
  First paired exchange matching run
  First non-directed altruistic donation

- Ongoing
  Review and refinement of the sharing schemes
Development of the current UK scheme
Simple beginnings

2007:

For the first year only 2-way exchanges were considered in the scheme of HLA and/or blood group incompatible pairs.

2008:

After one year, 3-way exchanges were also considered.
Changes to scheme in 2012

- Short altruistic donor chains introduced
- Compatible pairs can join
- Patients can be registered for blood group or HLA incompatible transplant through the scheme
Further changes in 2015 & 2018

2012:
Short Altruistic Donor Chain

2015:
Long Altruistic Donor Chain (and non-simultaneous surgery in chains)

2018:
Chain donation is default option for altruistic donors (rather than have option of donation direct to waiting list)
The scheme today - matching runs identify....

2-way

3-way
The scheme today - matching runs identify….

2-way

Short Altruistic Donor Chains

Long Altruistic Donor Chains

3-way
Identifying Optimal Combination of Transplants

- Over 200 pairs every ‘matching run’
- This results in 2000-5000 arcs (donor-recipient matches)
- Arcs are weighted to give preference to certain matches
- Seek to maximise number of transplants according to criteria developed with transplant community

Matching software implemented by colleagues at University of Glasgow, School of Computing Science
Identifying Optimal Combination of Transplants

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Acknowledgement: Tommy Muggleton
### Matching Principles

**Optimal Combination of Transplants**

1. Maximise 2-way exchanges (inc. embedded in 3-way)
2. Maximise number of transplants
3. Minimise 3-way exchanges
4. Maximise 3-way with embedded 2-way and long chains
5. Maximise ‘score’ of set of transplants

#### Score based on

- Previous matching runs for patient
- Sensitisation of patient
- HLA mismatch of identified transplant
- Donor-donor age difference

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1. Matching software implemented by colleagues at University of Glasgow, School of Computing Science
Other scheme developments considered

1. Should we run the matching more frequently?
2. Should we match altruistic donors as and when they arise?
3. What about Non-simultaneous Extended Altruistic Donor (NEAD) chains?

No conclusive (simulation) evidence of any strong benefit of such changes:

<table>
<thead>
<tr>
<th>Policy</th>
<th>Transplants over 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current scheme policy</td>
<td>(Baseline)</td>
</tr>
<tr>
<td>Matching runs every 2 months</td>
<td>+ 3%</td>
</tr>
<tr>
<td>Matching altruistic donors every week</td>
<td>- 2%</td>
</tr>
<tr>
<td>NEAD chains</td>
<td>+ 2-3% (2% renege rate) - 7% (10% renege rate)</td>
</tr>
</tbody>
</table>
Current activity
Number of Patients in Quarterly Matching Runs

No. of patients included in run

Matching run

Apr 2007 (9 patients)

Jan 2018 (242 patients)

New patients
Existing patients

Matching runs:
- Jan 2018: 242 patients
- Apr 2007: 9 patients
Summary of Registered Patients

Of 1874 patients (2068 pairs) enrolled (to Jan 2018)

- 44% spouse/partner pairs, 55% female patients
- Mean age at first matching run 46 years (range 2-78 yrs)
- 61% HLA incompatible, 34% ABO incompatible, 5% compatible pairs
- 42% patients with high level of antibodies (≥85% sensitised)
Number of Transplants

No. of Transplants

Apr 2007 | Matching run | Oct 2017

0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60

3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43
### Chance of transplant by blood group

2012 - 2017

<table>
<thead>
<tr>
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## Chance of transplant by blood group

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Chance of transplant by cRF*

* Calculated Reaction Frequency (overall to Jan 2018)
Antibody incompatible transplants through the scheme

- Planned incompatible allowed through scheme: 41 recorded as incompatible – 41 HLAi and 3 ABOi

Approx 8% of scheme transplants in 2016/17
Impact on Antibody Incompatible Transplants

Transplants

- HLAi
- ABOi
- Paired Donor
Survival Outcomes – Graft Survival

Based on transplants April 2007 – March 2011

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<td>94.1 (92-95) 1002</td>
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<td>Paired exchange donor</td>
<td>93.4 (86-97) 91</td>
</tr>
<tr>
<td>Altruistic donor</td>
<td>91.3 (80-96) 61</td>
</tr>
<tr>
<td>ABO incompatible donor</td>
<td>91.1 (86-94) 220</td>
</tr>
<tr>
<td>Related donor</td>
<td>90.7 (89-92) 1958</td>
</tr>
<tr>
<td>HLA incompatible donor</td>
<td>80.0 (74-85) 215</td>
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p<0.0001, log-rank test  5 df

Based on transplants April 2007 – March 2011
Survival Outcomes – Patient Survival

Survival % (95% CI) N

- Related donor: 95.7 (95-97) 1727
- Paired exchange donor: 93.9 (85-98) 66
- Unrelated donor: 92.9 (91-94) 906
- HLA incompatible donor: 91.3 (84-95) 111
- ABO incompatible donor: 91.2 (86-94) 200
- Altruistic donor: 88.2 (76-95) 52

P=0.003, log-rank test 5 df

Based on transplants April 2007 – March 2011
Summary of activity

- 1874 patients registered in the scheme since 2007
- 842 patients have received a transplant through the scheme

- 15 transplants in children
- 32 transplants (44% of registered) for compatible pairs = transplants for 50 others
Making it happen……..
Our Ambition

Maximise opportunities for donors and recipients to contribute to and benefit from the UKLKSS by ensuring that the schemes are clinically and cost effective

- 75% of matched donors proceed to donation and achieve maximum number of transplants
- All donors and recipients proceed to surgery within 8 weeks of a suitable match being identified

“To match world class performance in living donor kidney transplantation”
Operational Aspects
Key Characteristics

• UK-wide scheme; centrally run by NHSBT
  – All UK transplant centres participate (adults & children)
  – All work up complete
  – Recipients can be registered with >1 donor
  – Incompatible and compatible pairs
  – Can define individual age & HLA match requirements
  – Permit simple HLA or ABO incompatible transplants through scheme
  – Kidneys travel

• Annual timetable; quarterly matching runs

• ‘Pre-run’ to confirm inclusion of potential donor matches

• All recipients suspended from national deceased donor transplant list once match identified
Challenges

• Size and complexity of the scheme; managing success
• Non-proceeding transplants; delays and cancellations
• Timely surgery and simultaneous coordination
• Complex cases; exchange of information between centres
• Completeness of registration data
• Maximising potential of non-directed altruistic kidney pool
• Awareness and access; clinical decision-making
• Clinical governance and reporting
Workshops: biennial/triennial

Problems

Solutions
Workshop Outcomes and Actions

- Presented to Kidney Advisory Group (KAG)
- Implementation by LDKT 2020 Strategy Group
Non-proceeding Transplants
Non-proceeding transplants

- 54% of identified transplants proceeded 2007-2011
- 67% proceeded 2012 - 2017
Non-proceeding transplants (2012-2017)

- Donor Unfit (8%)
- Donor Withdrew (10%)
- Other (28%)
- Positive X-match (25%)
- Recip Unfit (24%)
- Recip Withdrew (5%)
Opportunities
Non-Directed Altruistic Donors

2-way (paired)

3-way (pooled)

Short Altruistic Donor Chains

Long Altruistic Donor Chains

Non-Directed Altruistic Donors
Non-Directed Altruistic Kidney Donors (NDADs)
NDADs By Donating Hospital
UK Living Kidney Sharing Schemes Performance Figures

**Total May 2007-October 2017**

- Pairs Registered: 2004
- Patients Registered: 1814
- Altruistic Donors in Paired Donation Matching Runs: 200
- Compatible Pairs Registered: 95
- Transplants: 805

**Paired Donation Transplants Identified**

- Transplanted
- Not Proceeding
- Yet to Proceed

**Patients in Each Matching Run**

- Existing Patient
- New Patient

**Non Proceeding Paired Donation Transplants**

- Donor unit
- Donor withdrew
- Other
- Pos x match
- Recip unit

**UKLKSS Records In a Matching Run**

- Pairs Included: 284 (Jul 2016)
- Patients Included: 256 (Jul 2016)
- Altruistic Donors Included: 15 (Oct 2013)
- Transplants Identified: 78 (Oct 2017)
- Transplants Proceeded: 57 (Oct 2015)

**Paired Donation Transplants by Type**

- Short Chain
- Long Chain
- 2-Way
- 3-Way

**Altruistic Donor Transplants**

- Donation to Transplant List
- Altruistic Donor Chains

Note: each reason may account for multiple transplants
Altruistic Kidney Donors

By December 2017:
635 Donations
791 Transplants
Innovations
Maximising Transplants
Tackling Non-Proceeding Transplants

• Donor-recipient registration
  – Electronic; mandatory fields for recipient preferences
  – Simplified timetable for including clinical and H&I data

• Agreed criteria for donor complexity and exchanging essential donor-recipient information

• Monitoring performance
  – Agreed governance structure- prior approval and reporting
  – On-line survey monkey for non-proceeding transplants
  – Re-categorisation for non-proceeding transplants
  – Quarterly UKLKSS bulletin: activity and performance
Increasing Flexibility

- Inclusion of compatible pairs, desensitisation and low risk ABOi for highly sensitised recipients
- Recipient age and HLA preferences registered at inclusion
- Streamlined timetable of key dates
- Agreed framework for non-simultaneous surgery
- Designated weeks of surgery- extended from 2 to 3 weeks (weeks 5,6,&8 post matching run)
- Electronic registration and reporting
Improving Access and Awareness

• All NDADs enter matching run unless there is a high priority recipient on the national transplant list

• Shared learning
  – UK Living Donor Kidney Network
  – Quarterly UKLKSS bulletin: activity and performance; shared learning, trends and solutions; KAG updates

• On-line decision-making resources (slides; ‘chance of transplant’ calculator)\(^1\)

• Revised portfolio of donor-recipient information\(^2\)

\(^1\)https://www.odt.nhs.uk/living-donation/living-donor-kidney-transplantation/
\(^2\)https://www.organdonation.nhs.uk//about-donation/living-donation/
What else could we do?

- Electronic offering system for UKLKSS- ‘Living EOS’
- Develop recipient ‘acceptable risk’ score to replace donor complexity
- Use on-line survey monkey reporting to inform further developments and improvements
- International collaboration to extend donor pool and transplant opportunities (COST- ENCKEP)
Impact?
Number of paired donation transplants by country

UK transplants represent about half of all European transplant activity

Summary

• Delivers effective kidney sharing across the UK
  – 842 (36%) registered recipients transplanted
  – 59% of identified transplants proceeded
  – 62% of transplants proceed within 8 weeks

• International reputation
  – Largest national scheme in Europe; central coordination
  – Maximises transplants and outcomes

• As transplant activity has increased, antibody incompatible transplant activity has decreased

• Continuous innovation and improvement is key to success
Acknowledgements

NHS Blood and Transplant colleagues
Lisa Mumford, Matthew Robb, Chloe Brown, Iain Harrison, Lin Shelper, David Clegg, Debbie West

University of Glasgow (matching algorithms)
David Manlove, Peter Biro, Gregg O’Malley, James Trimble

Transplant centres and referring renal units

Kidney Advisory Group

LDKT 2020 Strategy Implementation Group
Aisling Courtney (Chair) and members

“To match world class performance in living donor kidney transplantation”
Thank You

NHS Organ Donor Card

Yes I donate
ORGAN DONATION

www.nhsbt.nhs.uk    www.odt.nhs.uk