

# SINGHEALTH DUKE-NUS TRANSPLANT CENTRE

ANNUAL REPORT 2019



*Gift of Life, Gift of Hope*

  
SingHealth DukeNUS  
ACADEMIC MEDICAL CENTRE

**Transplant Centre**



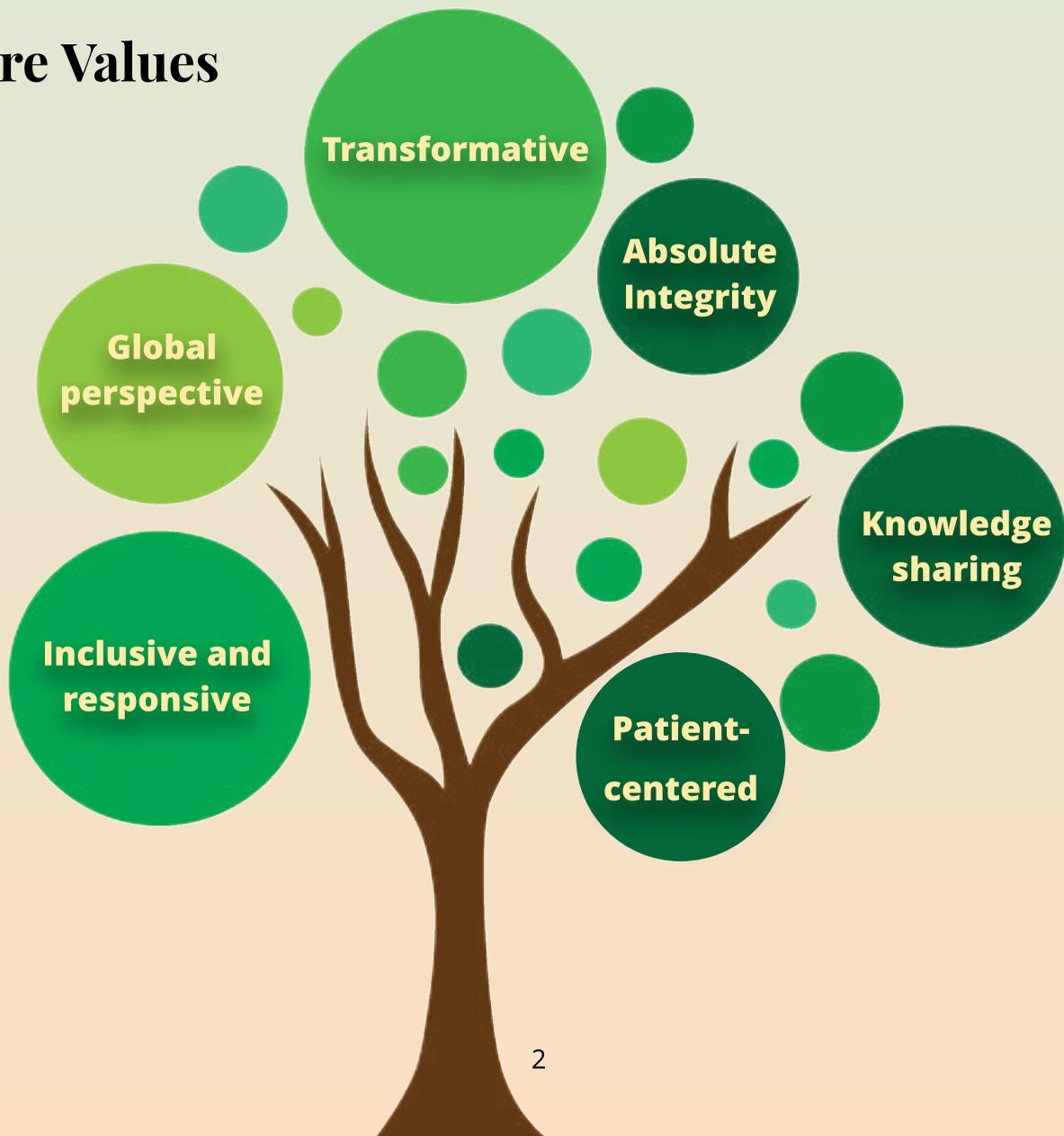
## Shared Purpose

To save and improve human lives by advancing the field of transplantation

## Vision

To double transplant survival, optimise quality of patients' lives and improve accessibility and affordability of transplantation for all in need.

## Core Values





# Transplant Centre

## Mission

A gathering of professionals dedicated to advancing the field of transplantation and improving patient care by promoting research, education, advocacy and organ, tissue and cell donation

### Clinical Services

Optimising quality and patient outcomes; advancing the frontier of transplantation

### Research

Double long term graft survival and optimise patient's quality of life

### Education

Build education programmes that support the needs of growing research, innovation and centres of clinical and academic excellence

### Advocacy

As the primary influencer & shaper of the regulatory landscape

### Development

Build a sustainable financial strategy to achieve short and long term goals



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# Director's Message



Dear colleagues,

2019 was a transformative year for transplantation in SingHealth. The SingHealth Duke-NUS Transplant Centre (SD Transplant Centre) was inaugurated in April 2019. This brought the solid organ transplant programmes as well as the tissue and cellular transplant programmes and the tissue banks under a recognised consolidated entity. The unifying move was done to encourage and enable colleagues in transplantation to advance collaboration in areas such as research, education and the development of new procedures and clinical services. This is in addition to improving our operations and improving multidisciplinary care for our patients.

The formation of the new Centre builds upon the foundations laid by various transplant programmes. It is my hope that what may be seen as a small step for SingHealth Transplant will mark a giant leap for the progress of transplant in SingHealth.

Legendary football coach, Vince Lombardi, famously said *"Perfection is not attainable, but if we chase perfection we can catch excellence"* and it is in this spirit of "pursuing perfection, catching excellence" that we at SD Transplant Centre will strive towards in defining tomorrow's medicine.

## **Advocating for Transplant Health**

As an advocate for transplant in Singapore, we organised the inaugural SD Transplant Centre Symposium in September 2019. Highlights included a lecture series presented by foreign and local speakers as well as two Transplant Surgical Workshops - a Kidney and Liver Transplant Surgical Workshop and an Abdominal Wall and Intestinal Transplant Workshop.

## **Pushing New Frontiers in Clinical Service**

We successfully performed the first laparoscopic liver donor hepatectomy and the patient was discharged on the third post-operative day. As the procedure is offered to more living donors, our patients can benefit from lower blood loss, reduced pain, faster recovery and superior aesthetics of the wound.

In adapting its role to support the increasing number of Descemet's Membrane Endothelial Keratoplasty (DMEK) performed at the Singapore National Eye Centre (SNEC), the Singapore Eye Bank (SEB) has evolved to undertake the task of processing corneas. Results have been excellent with all 50 of their initial procedures performed successfully and released for transplant.

## **Collaborating on Groundbreaking Research**

With the support of the Lee Foundation Grant (LFG), the haematopoietic stem cells transplant team, together with the liver and renal transplant teams, have embarked on two collaborative research projects to induce tolerance in transplant recipients by replacing their immune system with that of the donor. A novel multivisceral transplant research project was embarked upon through the generous support of the philanthropic John 3:16 Multivisceral Transplant Fund.

## **Adapting to the Future**

Needless to say the COVID-19 pandemic will define 2020. However we are fortunate that in 2019 the SD Transplant Centre was formed and this enabled our transplant teams currently to meet the challenges of this pandemic through collaborations and coordination. Even though the COVID-19 pandemic greatly affected the way we work, the formation of the SD Transplant Centre was thus a fortunate stroke of serendipity. I am proud that everyone in the SD Transplant Centre has pulled together in these trying times to adapt quickly to the new norms of working. We remain steadfast in upholding a high standard of care for our patients with robust protocols in place so we all stay safe.

**Assoc Prof Jeyaraj Prema Raj**  
Head,  
SingHealth Duke-NUS Transplant Centre

## Our Activities and Achievements - A Snapshot

### Efforts & Impact in Transplant Education



#### 1850 Nurses

- Organ Donation and Transplantation awareness talks conducted during Level 1 and Level 2 nurses induction
- In-service Nursing Talks which presented on various topics by our transplant doctors

#### 340 Residents

Internal Medical Residency Talks conducted on Living Kidney Donation, Corneal Transplant and Organ Donation and Transplantation awareness

#### 531 Healthcare Professionals

Awareness was raised on Organ and Tissue Donation and Transplantation, A donor Liver's value chain, Types of Death and the intricacies in the procedures of Organ Donation.

#### 34 Students

School visits to Tissue Banks were conducted to share about Tissue Banking; Skin, Homograft and Corneal Transplant and Organ Donation and Transplantation Awareness.

### Symposiums & Visiting Experts

Symposiums	Visiting Experts	Specialties
Advanced Lung Diseases and Therapies Forum 2019	Duke Medical Centre - 2	Lung Transplant
Inaugural Transplant Symposium 2019	Duke Medical Centre - 2 King's College - 2 Kyoto Prefectural University of Medicine - 1	Multi-Visceral Transplant Critical Care, Liver Transplant Corneal Cell Therapies
3rd Biennial Asia Pacific Mechanical Circulatory Support Conference 2019	HMDP - King's College - 1	Donation after Circulatory Death, Critical Care

### Professional Development

#### Professional Achievements

##### Heart, Renal, Liver and Procurement

4 Transplant coordinators attained Postgraduate Diplomas in Organ Procurement and Transplantation

##### H SCT Paediatric

3 Paediatric nurses and paediatric H/O service sponsored one staff registrar for the European Society for Blood and Marrow Transplantation (EBMT) training in Spain.

### Fostering Ties Beyond Borders

#### Liver

- Organised a one-week Liver Transplant Training Programme for Kandy Teaching Hospital, Sri Lanka in partnership with SingHealth International Collaboration Office
- Hosted an academic exchange with Shanghai Renji Hospital

#### Heart

- Appointed by industry partners as the Centre of Excellence for LVAD in Asia region – proctoring and training for centres in Thailand and India.

### Educational Courses and Workshops

- Kidney & Liver Transplant Surgical Workshop
- Abdominal Wall and Intestinal Transplant Workshop
- Advance Corneal Surgery ALK/DSAEEK/DMEK Course
- Singapore Eye Bank Corneal Procurement Accreditation Course
- Asia Pacific Burn Congress-Pre-Congress Skin Banking Workshop ("Skin banking: Recovery, processing, storage and distribution of human donated skin")

# Clinical Quality Highlights

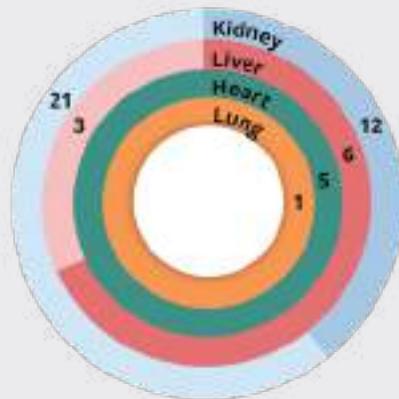
Since Inception

**12,439 Transplants**  
performed  
Giving new life and new hope to  
patients and their families

In 2019

**701 Transplants**  
performed  
**24 Deceased Donor Organ Transplants**  
were made possible by the  
gifts of life and hope from  
**16 Donors**

## Solid Organ Transplantation



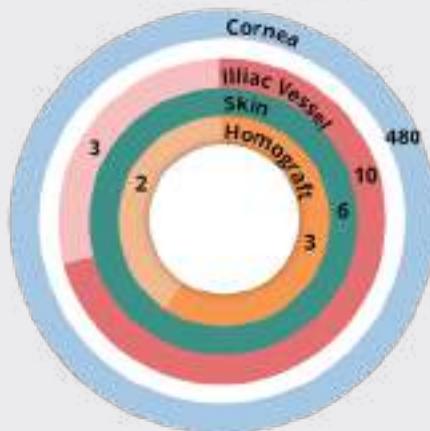
**Kidney**  
12 Deceased Donor Transplants  
21 Living Donor Transplants

**Liver**  
6 Deceased Donor Transplants  
3 Living Donor Transplants

**Heart**  
5 Deceased Donor Transplants

**Lung**  
1 Deceased Donor Transplant

## Tissue Transplantation



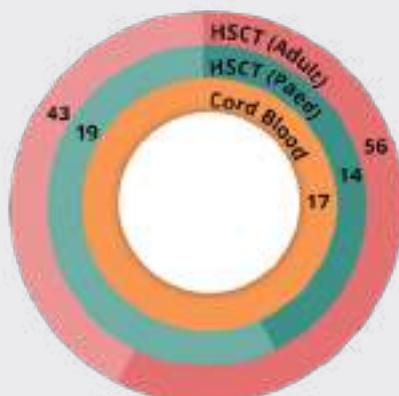
**Cornea**  
480 Transplants

**Iliac Vessel**  
3 Iliac Artery Implants  
10 Iliac Vein Implants

**Skin**  
6 Transplants

**Cardiovascular Homograft**  
3 Aortic Valve Implants  
2 Pulmonary Valve Implants

## Stem Cell Transplantation



**Haematopoietic Stem Cell (Adult)**  
56 Autologous Transplants  
43 Allogeneic Transplants

**Haematopoietic Stem Cell (Paediatric)**  
14 Autologous Transplants  
19 Allogeneic Transplants

**Umbilical Cord Blood  
(Singapore Cord Blood Bank)**  
17 Transplants

Note: Diagram above not drawn to scale

# Patient and Graft Survival

## Solid Organ Transplantation

Organ Type	Years of Survival	Patient Survival		Graft Survival	
		Deceased Donor Transplant	Living Donor Transplant	Deceased Donor Transplant	Living Donor Transplant
Kidney	1 Year	100%	100%	100% <sup>†</sup>	100% <sup>†</sup>
	5 Years	100%	100%	94.7% <sup>†</sup>	100% <sup>†</sup>
Liver <sup>#</sup>	1 Year	91.7%	80.5%	95.8%*	87.8%*
	3 Years	89.2%	68.2%	95.8%*	84.8%*
	5 Years	87.6%		95.8%*	
Heart	1 Year	77.3%			
	5 Years	68.8%			
	10 Years	54.9%			
Lung	5 Years	53.3%			

# Refer to liver transplant programme's patient survival rates for the period of 2015 - 2019.

Years of Survival	Patient Survival	Graft Survival
	Living Donor Transplant	Living Donor Transplant
1 Year	100%	100%*
3 Years	88.8%	100%*

## Tissue Transplantation

Tissue Type	Years of Survival	Graft Survival		
		Primary optical cases using the following surgical techniques		
		Penetrating Keratoplasty	Deep Anterior Lamellar Keratoplasty	Endothelial Keratoplast
Cornea	1 Year	93.2%	96.8%	95.8%
	5 Years	67.5%	95.8%	83.0%
	10 Years	58.5%	95.3%	76.4%
Cardiovascular Homograft	5 Years	94.7%		

## Stem Cell Transplantation

	Years of Survival	Patient Overall Survival	
		First time transplants for the following indications	
		Acute Myeloid Leukaemia	Acute Lymphoblastic Leukaemia
HSCT (Adult)	1 Year	69.9%	65.3%
	5 Years	54.7%	52.1%
	10 Years	38.3%	39.9%
HSCT (Paediatric)	Patient Overall Survival		
	First time allogeneic transplants for high risk leukaemia		
	1 Year	86.5%	
5 Years	68.4%		
10 Years	52.2%		

● Above International Benchmark    
 ● Below International Benchmark    
 ● Not Applicable

^ Not censored for death    \* Censored for death    † International benchmark unavailable  
 Refer to Transplant Programme Reports from page 24 to page 41 for the periods analysed and benchmark details.

# International Benchmarks

## Solid Organ Transplantation

### Kidney

- 1) Australia and New Zealand (ANZ) Dialysis and Transplant Registry 41<sup>st</sup> Report
- 2) National Health Service (NHS) Annual Report 2017/2018 on kidney transplantation
- 3) Organ Procurement and Transplantation Network (OPTN) National Data Report on kidney transplantation

### Liver

- 1) OPTN Scientific Registry of Transplant Recipients (SRT) 2018 Annual Data Report: Liver
- 2) NHS (Blood and Transplant Annual Report 2017/2018): Liver Transplantation
- 3) Living donor liver transplantation in Europe HepatoBiliary Surg Nutr 2016;5(2):159-171.

### Heart and Lung

- 1) International Society for Heart and Lung Transplantation (ISHLT)

Organ Type	Years of Survival	Patient Survival		Graft Survival	
		Deceased Donor Transplant	Living Donor Transplant	Deceased Donor Transplant	Living Donor Transplant
Kidney	1 Year	96.2% to 97.0%	98.8% to 100%	91.2% to 94.3% <sup>^</sup>	87.6% to 88.0% <sup>^</sup>
	5 Years	83.2% to 87.0%	92.1% to 96.0%	71.4% to 86.2% <sup>^</sup>	85.2% to 90.9% <sup>^</sup>
Liver	1 Year	>90.7%	>88.0%	>86.2% <sup>^</sup>	>85.0% <sup>^</sup>
	3 Years	>84.0%	>83.0%	>83.0% <sup>^</sup>	72.0% <sup>^</sup>
	5 Years	>81.0%		>75.0% <sup>^</sup>	
Heart	1 Year	83.7%			
	5 Years	72.4%			
	10 Years	58.1%			
Lung	5 Years	58.7%			

## Tissue Transplantation

### Cornea

- 1) Australian Cornea Graft Registry - 2018 report

### Cardiovascular Homograft

- 1) Troost E, Meyns B, Daenen W, et al. Homograft survival after tetralogy of Fallot repair: determinants of accelerated homograft degeneration. European Journal of Cardiology. 2017. 28: 2503-2509.
- 2) Kilian E, Oberhoffer M, Gulbins H, et al. Ten years' experience in aortic valve replacement with homograft in 389 cases. Journal of Heart Valve Diseases. 2004. 13(4): 554-559.

Tissue Type	Years of Survival	Graft Survival		
		Primary optical cases using the following surgical techniques		
		Penetrating Keratoplasty	Deep Anterior Lamellar Keratoplasty	Endothelial Keratoplast
Cornea	1 Year	83%	94%	87%
	5 Years	73%	84%	69%
	10 Years	64%	60%	41%
Cardiovascular Homograft	5 Years	88.3% to >90%		

## Stem Cell Transplantation

### Haematopoietic Stem Cell Transplant (Adult) & Haematopoietic Stem Cell Transplant (Paediatric)

- 1) Center for International Blood & Marrow Transplant Research (CIBMTR)

HSCT (Adult)	Years of Survival	Patient Overall Survival	
		Acute Myeloid Leukaemia	Acute Lymphoblastic Leukaemia
HSCT (Adult)	1 Year	45% to 85%	40% to 87%
	5 Years	25% to 60%	20% to 60%
	10 Years	Not available	Not available
HSCT (Paediatric)	Patient Overall Survival		
	First time allogeneic transplants for high risk leukaemia		
	1 Year	ALL: 75%, AML: 85%	
5 Years	ALL: 64%, AML: 80%		
10 Years	Not available		

<sup>^</sup> Not censored for death

Refer to Transplant Programme Reports from page 37 to page 55 for details on the benchmark details.

# Research Highlights

## Research Focus at a Glance

1. Integration of pre-clinical models with human clinical immunology
2. State-of-art technologies to transplant research
3. Long term graft survival
4. Immunotolerance
5. Organ injury & resuscitation
6. Pharmacogenomics
7. Psychosocial issues in transplant



## Awards

### Dr Alvin Chua

Assistant Director (Transplant Research), Department of Plastic, Reconstructive & Aesthetic Surgery, SGH  
SingHealth Duke-NUS Research Team Awards 2019 (2nd prize)

### Dr Michaela Seng

Consultant, Med: Paed Subspec, Haematology/Oncology Service

NMRC Award

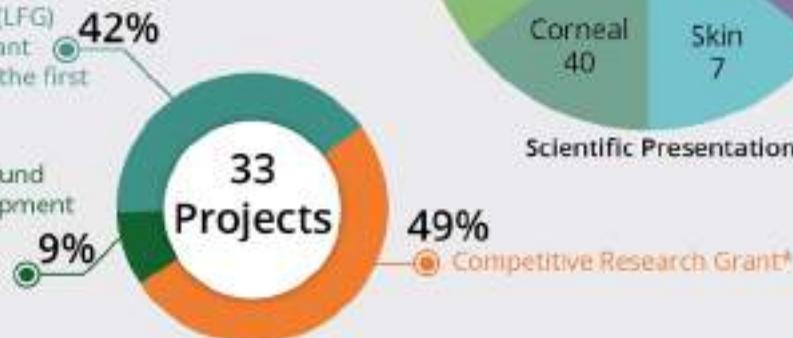
Developing the application of T regulatory cells & CD62L-depleted CART cells in adoptive cell therapy 2019



## Active Research Projects

Lee Foundation Grant (LFG) has supported transplant related research since the first grant call in 2015

John 3:16 is a philanthropic fund set up to support the development of a multivisceral transplant service in SingHealth

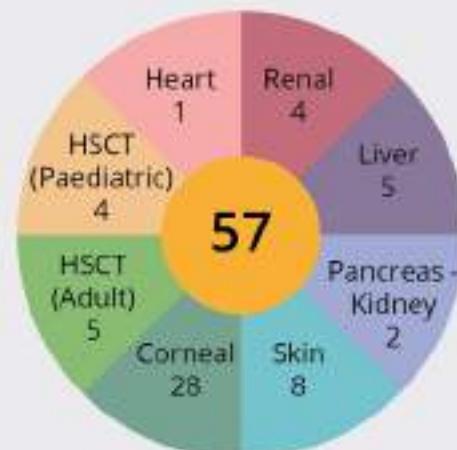


## Active Research Projects

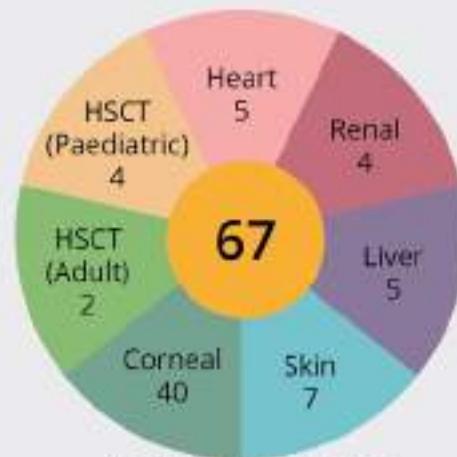
Heart	2	Corneal	7
Liver	5	HSCT (Adult)	2
Renal	3	Ovarian	1
Pancreas - Kidney	2	Skin	4
Combined research by HSCT and Liver Transplant	1	Combined research by HSCT and Renal Transplant	1
MVT	3	Psychosocial Studies	2

\*Note: Includes funding from Duke-NUS Medical School Khoo Bridge Funding Award, Duke-Singhealth Collaborative Grant, NMRC Centre Grant-Collaborative Post SGH & NDCS, Clinical Trial Grant, Clinical Scientist Award, SGH Health Development Fund, SNEC Health Research Endowment Fund, SNEC Corneal Departmental Fund, SNEC Health Research Endowment Fund, Singapore Eye Bank, HSDP MOH, Abbott, SRG Funding.

## Research Output



Academic Journal Publication



Scientific Presentation

# Transplantation Highlights

## Focused Outreach Efforts for Living Donor Renal Transplant (LDRT) at Changi General Hospital (CGH), Sengkang General Hospital (SKH) & the National Kidney Foundation (NKF)

In 2019, the Singapore (SGH) Renal Transplant programme launched two initiatives aimed at increasing awareness in LDRT.

The first was the SGH-CGH Transplant Outreach Programme introduced in February 2019. The programme differed from regular LDRT counseling conducted at SGH in that it was designed to transform the mindset and disposition of patients and families towards LDRT. In this programme, renal transplant coordinators only counsel patients who are suitable for but not interested to receive a LDRT. Transplant coordinators would address patients' knowledge, needs, motivation and resistance during the session. It is believed that this helps in encouraging patients towards accepting LDRT.

In January 2020, SKH also participated in this programme. The results from the partnership was excellent with **a 500% increase in referrals from CGH and 60% increase in referrals from SKH.**

In a second initiative to engage partners external to SingHealth, the renal transplant team also collaborated with the NKF and introduced the Transplant Ambassador Programme for their dialysis nurses. **The first Ambassador Training Course was held in June 2019, where 42 dialysis nurses participated in a didactic lecture on renal transplantation.** Training also included role playing to simulate different patient counseling scenarios. This initiative focused on empowering the dialysis providers in identifying suitable transplant candidates, as well as equipping them with the knowledge and skills to encourage suitable patients to consider kidney transplant.

Aside from NKF nurses, a lecture series was also designed to engage and educate NKF's patients and their families. The team is happy to share that their efforts have borne fruit, as a patient who attended the lecture underwent a LDRT in December 2019.



*A/Prof Terence Kee presenting at the NKF patient lecture series in June 2019*

## Advocating for Simultaneous Pancreas-Kidney (SPK) Transplant

Two in three new kidney failure cases are currently due to diabetes-related complications. A national health survey by MOH in 2010 revealed that 444,000 Singapore residents aged 18 years and above were diagnosed with diabetes in 2014. This number is estimated to grow to 1,000,000 by the year 2050 in a projection done by the Saw Swee Hock School of Public Health in Singapore. With the prevalence of diabetes in Singapore being exceedingly high and continuing to rise at a rapid rate, it is imperative that therapies with substantial proven efficacy, most importantly the SPK transplant, are advocated for and become routine within the Singapore health system to effectively manage such cases in the long term.

The Pancreas-Kidney Transplant Programme, established in 2012, is a collaborative effort between the SGH and the National University Hospital (NUH). Singapore's first SPK transplant was successfully carried out the same year. This landmark surgery carries vast therapeutic potential and offers a much needed lifeline for patients who suffer from concurrent diabetes and kidney failure. Multiple studies have shown that the five-year patient and graft survival rate for SPK patients ranged from 91% to 89% as compared to 78% to 76% for patients who have undergone kidney transplantation alone. Overall, SPK transplant was associated with better graft and patient survival and showed significantly better survival beyond five years, post transplantation. More importantly, patients enjoy a greater quality of life that is free from complications associated with diabetes such as dialysis, insulin and the need for a tightly restricted diet.

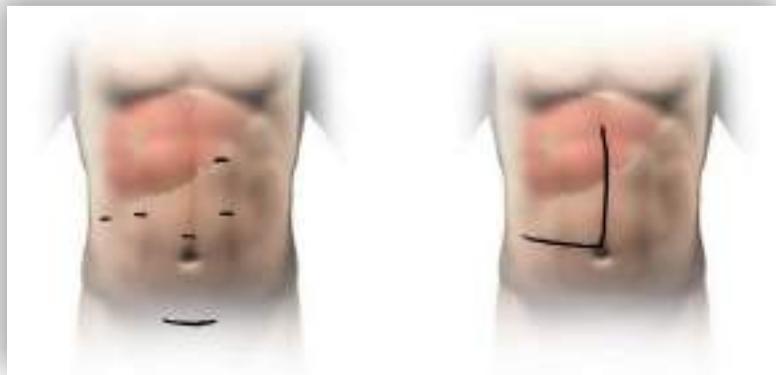
With the current improving results in SPK transplantation, patients with Type 1 and even selected Type 2 DM kidney disease are being treated with this technique with excellent results.

As part of our outreach efforts, the transplant team is actively engaging both SingHealth and external institutions through talks with clinicians and increasing awareness of the availability of the service in SGH. An example of such efforts is the Brown Bag Lunch Talk series that took place during Transplant Awareness Month in October 2018, organised by the SD Transplant Centre.

### Improving Living Liver Donor Experience Through Laparoscopic Liver Resection

Over the past few years, the Department of Hepato-pancreato-biliary and Transplant Surgery at SGH has acquired considerable expertise and experience with laparoscopic liver resection, a minimally invasive procedure to remove liver mass. This was achieved through the acquisition of skills, manpower training, expanding the repertoire of indications and the extent of resections. Institutional support in providing state-of-the-art equipment also greatly facilitated these surgeries. Parallel to our development, a core group was formed comprising of anaesthetists with an interest in liver surgeries and dedicated specialty Operating Theatre (OT) nurses to work closely with surgeons to ensure best possible outcomes. This high level of cooperation allows the team to offer the benefits of laparoscopic surgery to living liver donors. **These benefits include lower blood loss, reduced pain, faster recovery and superior aesthetics of the wound.**

The team performed its **first laparoscopic donor hepatectomy in March 2019**. The surgery and post-operative recovery were uneventful and the donor was discharged on the third post-operative day. Three further surgeries have since been performed and all the donors reported very positive experiences. The team continues to build on their experience, undertaking cases with increasing technical complexity. The high stakes nature of living liver donation, combined with the use of laparoscopic procedures, has enabled the SGH Liver Transplant Programme to be ranked amongst the few top centres in the world to perform this surgery. The programme aims to offer this surgery to the majority of living liver donors as it matures further.



*Laparoscopic surgery leads to lower blood loss, reduced pain, faster recovery and superior aesthetics for living donors*

## Asia Pacific Skin Banking Guidelines – Allowing Cross Border Skin Utilisation

A supply of skin allografts is an important resource to have when treating severe burn victims, especially in mass casualty or emergency situations. In the absence of common tissue banking standards and practices to manage such resources, members of the Asia Pacific Burn Association (APBA) set out to develop the Asia Pacific Skin Banking Guidelines for the region.

The guidelines serve as a standardised quality measure, governing the multifaceted processes of skin banking. **Harmonising skin banking practices would open up various opportunities for the diverse skin banks in the Asia Pacific region to collaborate and support one another.** This will be especially vital in times of crisis where the exchange of donated skin can be hastened, knowing that the different skin banks are conforming to the same set of guidelines, giving the assurance that the skin allografts are safe for therapeutic applications.

The guidelines were drafted through a series of working group meetings held in APBA member cities. On 30 November 2018, the draft was presented to the Steering Group Committee and was accepted with minor recommendations on being less prescriptive in order to cater to a wider audience in the region.

Having a supply of skin allografts in mass casualty or emergency situations is an important resource for the management of severe burn victims. Despite that, there were no common tissue banking standard and practice in the Asia Pacific region. Acknowledging this, members of the APBA agreed that there was a need to develop a set of common skin banking guidelines for the Asia Pacific region.

**The Asia Pacific Skin Banking Guidelines were officially launched during the 12<sup>th</sup> Asia Pacific Burn Congress (APBC) held in Singapore on 16 August 2019 with representatives from ten of the eleven member countries participating in the signing ceremony.** This initiative was led mainly by the SGH Skin Bank Unit and the guidelines were well received by the APBC delegates. To raise further awareness of this guidelines harmonisation in this region, an article entitles "A Review of Skin Banking Guidelines and Standards Worldwide: Towards the Harmonisation of Guidelines for Skin Banking in Therapeutic Applications for the Regions under the Asia Pacific Burn Association" was submitted to the Burns & Trauma journal. This article has been accepted for publication on 10 April 2020.



Common skin banking guidelines for APBC - the journey



The signing ceremony to officially launch the Asia Pacific Skin Banking Guidelines with representatives from 10 cities

## Commencement of Descemet's Membrane Endothelial Keratoplasty (DMEK) Tissue Processing Service

### Advancement of Corneal Transplantation

The management of corneal endothelial disorders has rapidly evolved over the past two decades, shifting from full thickness transplant Penetrating Keratoplasty (PK) to a selective posterior lamellar replacement surgery called Endothelial Keratoplasty (EK). With patients demanding more predictable transplant outcomes such as better visual acuity, lower graft rejection and complication rates, surgeons around the world have developed various iterations of EK. The two most widely recognised and accepted forms of EK are Descemet Stripping Endothelial Keratoplasty (DSEK) where the Descemet's membrane and a thin sliver of corneal stroma is excised and implanted, and the more recent Descemet's Membrane Endothelial Keratoplasty (DMEK) where only the Descemet's membrane (DM) is stripped from the donor and transplanted into the recipient. **DSEK remains the most widely performed EK procedure in the world but DMEK is fast catching up.** In the USA, DMEK transplant rates in 2018 have increased by 41% compared to the year before whereas rates in Singapore increased by 18% over the same period.

### Evolving Role of Eye Banks in Corneal Transplantation

Donor tissue preparation for EK was traditionally performed by the surgeon in the OT. However, with advancements in transplant innovations, eye banks have evolved to meet the surgeons' needs. From solely storing and distributing donor tissue, eye banks have now assumed a vital role in processing corneas within their own premises under strict quality control, thus assuring better outcomes for the patient.

Although the advantages of DMEK over DSEK have been validated by several studies (Marianne O. Price 2009, Raquel et al, 2019), numerous challenges exist which deter DSEK surgeons from shifting to DMEK. These include higher rates of tissue wastage during preparation, difficulty in graft handling during insertion and higher rates of graft dislocation. The first critical step in DMEK surgery is to strip the Descemet's Membrane from the donor cornea. By allowing the eye bank to assume this task, the surgeon is free to devote his or her full attention to the actual surgical procedure, which, in itself is quite challenging.

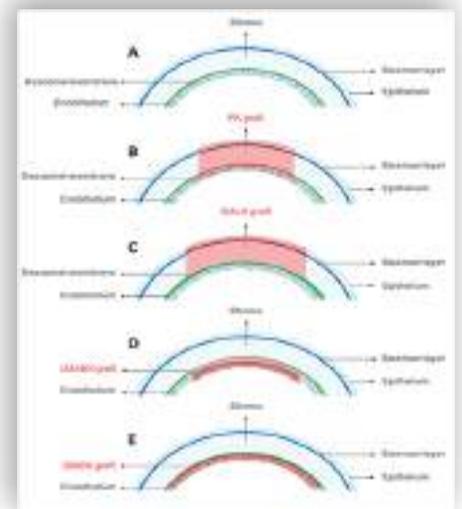
Various DMEK tissue preparation techniques have been proposed over the years, from Melles' manual dissection technique to pneumatic dissection and hydrodissection. One of the more popular techniques is the Submerged Cornea Using Backgrounds Away (SCUBA) technique which was first introduced in 2007.

An eye bank planning to start a DMEK tissue preparation service must therefore consider potential wastage rates, outcome predictability and reproducibility, and ease of skills transfer when selecting a technique. After extensive trials and wet labs with SNEC cornea surgeons and external consultants, **the SEB adopted the Modified SCUBA method.** Submerging the donor cornea under fluid avoids the forces of surface tension and simplifies the peeling of Descemet's Membrane, allowing large sheets to be easily dissected without tearing. Satisfied that we have selected the correct technique and after obtaining permission from management, **SEB commenced processing corneas in April 2019 to support the increasing number of DMEK surgeries in SNEC.**

### Initial Results

**All 50 of our initial procedures were successfully performed** and released for transplant. We were able to obtain good endothelial counts post-preparation with an average endothelial cell loss of 0.3%, which is comparable to published literature. Only half of the procedures had horseshoe tears and the average preparation time is 23 minutes. Four cases (8%) had multiple tears around the scored edges but in all cases, the tears were beyond the 8.5 mm transplant zone.

One case had no stromal hinge attached but DM was successfully replaced back to the stromal bed. The second case had multiple horseshoe tears and the operator elected to create a central hinge instead of the standard peripheral hinge. Six cases required redubbing (12%) and one case required an early re-graft.



Evolution of the treatment options for corneal endothelial disorders

**Future Plans**

SEB is still in its early stages of DMEK tissue preparation. However, **we plan to further enhance our capabilities by providing orientation marks and pre-loaded tissue to surgeons who request for them.** Once we have sufficient numbers, the pre-stripped corneas will be rolled out to all cornea surgeons in Singapore wishing to perform DMEK. Being one of the pioneer Asian eye banks to offer this service, we can also share what we have learnt with our eye bank colleagues in the region who also wish to have a similar set-up in their home country.

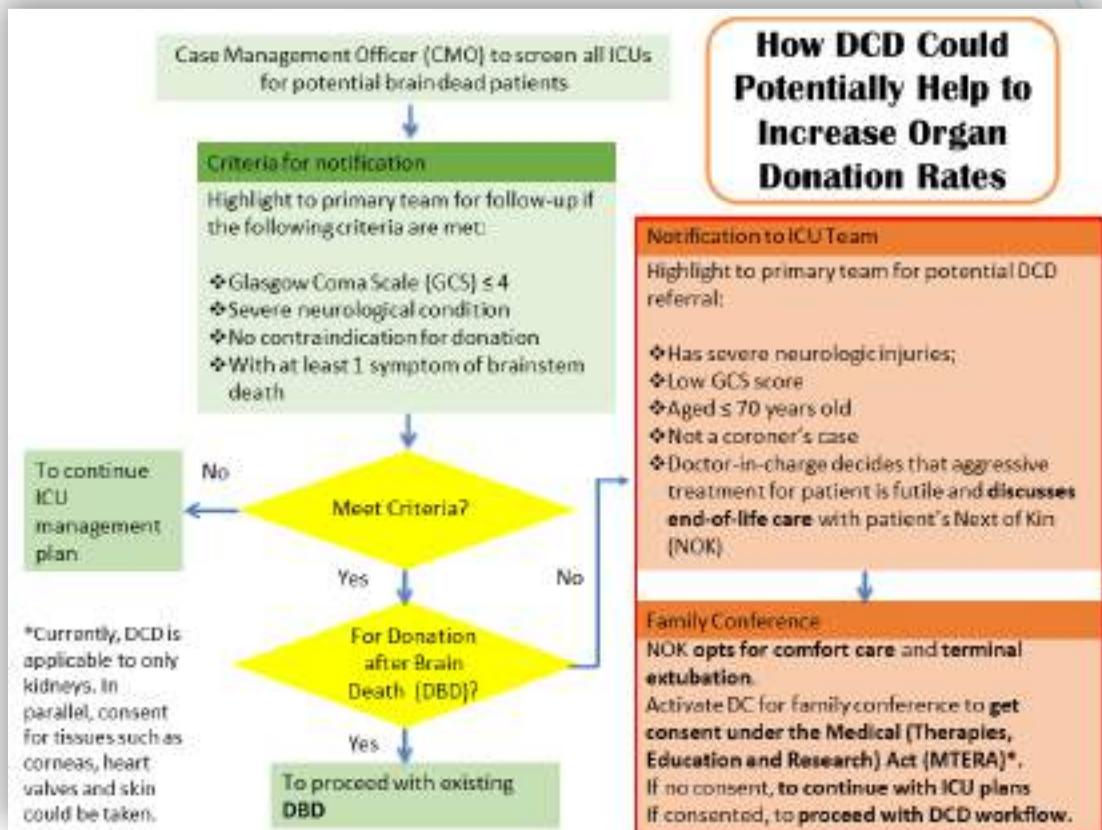
**Setting-up a New Avenue for Organ and Tissue Donation**

The SingHealth Donation after Circulatory Death (DCD) Implementation Committee was set up in November 2017 to establish DCD in SGH and carry out the necessary groundwork in anticipation of being part of a DCD kidney pilot trial by the Ministry of Health (MOH) from 15 May 2019 to 31 Mar 2022. Building on the protocol and education materials that were developed, our clinical leads and transplant coordinators conducted multiple sharing sessions with stakeholders in the various Intensive Care Units (ICU) and OT. Responses from the various groups of healthcare professionals were encouraging and they showed great interest in making DCD a success.

Timing is vital in DCD – this means that the time required to transport the donor to the OT should be minimised in order to optimise the transplant opportunity. Hence committee members conducted a simulation run with our stakeholders in the ICUs and OT to better understand the time required for this to take place in various scenarios.

This led to the realisation that more stakeholders need to be involved including security colleagues, to streamline the transportation process. This truly encapsulates the multi-disciplinary nature of transplant.

Although the pilot trial currently pertains to only the recovery of DCD kidney, **the transplant teams at SGH would like to explore this pathway in the future for the recovery of other organs and tissues.** This, we believe, will offer families an alternative pathway to organ donation and allow more patients to benefit from the gift of life.



# Quality and Safety

## Initiatives for Quality Improvement

### Cluster Initiatives

- 1) Streamlined consent-taking for solid organ transplantation at the point of registering patient for placement on the transplant waiting list and just prior to transplantation when the transplant donor is available
- 2) Established protocol for collection of tissue and/or non-tissue specimens from patients for biobanking into the SingHealth Tissue Repository (STR)

### Programme Initiatives

#### Renal Transplant Programme

Streamlined recipient coordination process to reduce cold ischemia time (CIT) to less than 12 hours

#### Liver Transplant Programme

Projects to continue:

- 1) Enhanced patient referral process:
  - (a) Introduction of online patient referral form for easy referrals by physicians
  - (b) Partnership with SingHealth institutions to provide transplant counselling to potential liver transplant patients at referring hospitals
- 2) Expanded liver transplantation through the use of Hepatitis B infected livers for chronic Hepatitis B patients and priority one patients with a high risk of death if they do not receive a liver transplant within six months

#### Heart Transplant Programme

- 1) Ongoing collaborative study with The Chinese University of Hong Kong on "Testing the Psychometric Properties of the Chinese LVAD Self-Efficiency Scale and LVAD Home Management Adherence Scale in Patients with LVAD and their caregivers"
- 2) Enrolled in the study amendment for an international commercial trial of HeartMate 3™ Registry to include up to 5 years of follow-up "Evaluating the HeartMate 3™ with Full Maglev Technology in a Post-Market Approval Setting (ELEVATE™)"
- 3) Active participation in the International Society for Heart and Lung Transplantation (ISHLT) registry for Mechanically Assisted Circulatory Support (IMACS)\*

#### Transplant Tissue Centre

Completed Asia-Pacific skin banking guidelines in collaboration with experts from 11 different countries

#### Haematopoietic Stem Cell Transplant (Adult) Programme

Achieved concurrent reporting to the Center for International Blood and Marrow Transplant Research (CIBMTR) and European Society for Blood and Marrow Transplantation (EBMT) by using quality improvement methodology. The median for overall pre-transplant essential data submission rate increased from 14% in March 2016 to 65% in September 2019. On average, by the end of project on 1 September 2019, 93.3 man hours per year or \$8,901.63 in manpower per year was saved.

#### Singapore Cord Blood Bank (SCBB)

Launched DocuSign, an online maternal donor recruitment application to enable informed consent for cord blood banking and donor evaluation to be done anywhere on supported electronic devices securely and confidentially. The increase in productivity had led to a 30% increase in maternal donor recruitment in the last quarter of 2019; from 1,471 donors in the 3<sup>rd</sup> quarter to 2,021 in the 4<sup>th</sup> quarter.

\*IMACS was temporarily put on hold since mid-2019 to assess its compliance with the European Union's General Data Protection Regulations (GDPR) and to also review changes to expand the data fields to improve the efficiency of the data submission process.

## New Method Enables Urgent Stem Cell Transplants to Proceed in the Absence of a Matched Donor - An update

By Haematopoietic Stem Cell Transplant Programme (Paediatric)

A novel haploidentical stem cell transplantation method that started in June 2017 **incorporating memory T cell infusion in children with high risk benign and malignant conditions** has enabled urgent stem cell transplants to proceed in the absence of a matched donor. A combination of two unique methods of selective T cell depletion (TCR alpha beta and CD45RA depletion) is performed on the peripheral blood stem cells collected from a donor by apheresis.

First, the most suitable haploidentical donor (usually the patient's parent or sibling) is identified based on a complex algorithm which includes killer immunoglobulin-like receptors (KIR) genotyping. Peripheral blood stem cells from the donor are divided in defined portions for TCR alpha beta and CD45RA depletion. This provides sufficient stem cells, graft facilitating cells and plenty of immune competent cells while reducing the alloreactive T cells to a very low level, thereby eliminating the risk of a severe graft versus host disease (GVHD). This combination provides an immediate anti-leukaemia effect and ensures fast immune reconstitution. Combined with ultrashort GVHD prophylaxis medication, it reduces the risk of leukaemia recurrence and serious infections post-transplant. The remaining stem cells and memory T cells collected from donor can also be used for enhancing the patient's immune reconstitution and for stem cell top-up if viral infection or poor graft function occurs.

To date, this strategy has been used in children with transfusion dependent thalassaemia, severe aplastic anaemia, primary immunodeficiency and also in children with high risk leukaemia with excellent preliminary results comparable to conventional stem cell transplantation.

## Introduction of Two-point Consent-taking in Solid Organ Transplantation

By SD Transplant Centre

Consent-taking involves an on-going process of interaction between clinicians and patients. Through adequate counselling and communication, patients are empowered to exercise their autonomy in making an informed decision about their own treatment.

A patient's transplant journey begins when they are referred to the respective solid organ transplant programme. To empower the patient in making a well-informed decision on deceased donor kidney, liver, heart or lung transplantation right from the start, an additional point of consent has been introduced. This new step precedes the standard consent which is taken just prior to the surgical procedure.

The first consent is taken upon registering the patient for placement on the wait list for deceased donor transplantation. The clinician counsels the patient with relevant information about the transplant, including the variability in organ quality, risks, benefits and alternative treatment options. This will also give the patient the opportunity to communicate the characteristics of donors and organs that are unacceptable to them.

The second consent is taken just prior to the transplantation, when a donor is available. This consent is legally binding. The clinician conducts an in-depth discussion with the patient, including information on the donated organ's condition and any associated risks to the patient's health so that the patient can make an informed decision about the transplantation.

Transplant waiting time ranges from months to years. While waiting for a deceased donor transplant, patients are continuously counselled and the consent taken at listing is reassessed when there are significant changes to the consent form, the patients' health condition or change in the patients' views or decision.

The two-point consent-taking will gradually be operationalised in all solid organ transplant programmes.

## Improving Transplant Outcomes Through Process Streamlining

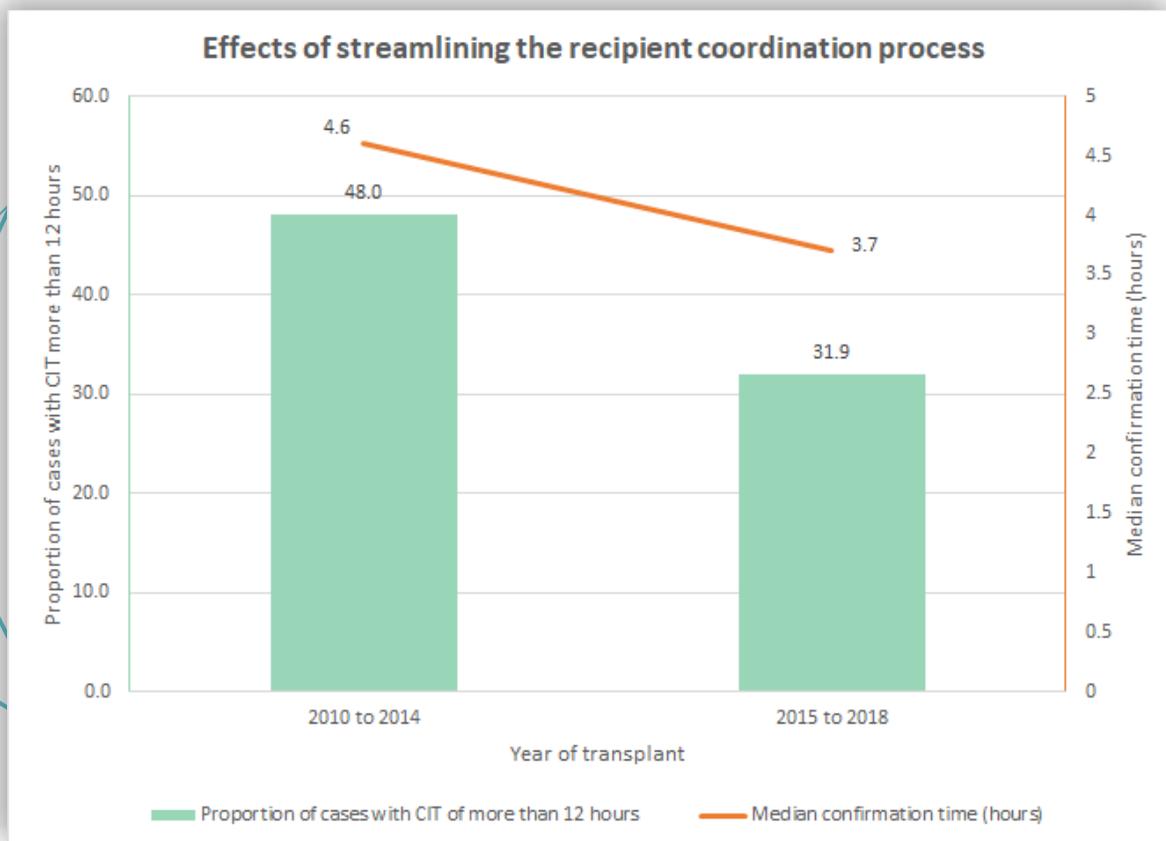
### By Renal Transplant Programme

Living kidney donor transplantation is the preferred treatment choice for eligible patients with end-stage kidney failure. However, not every patient will have a living kidney donor and those without one will need to be placed on the waiting list for a deceased donor kidney transplant. When a deceased donor is available, it is important to limit the amount of time that the recovered kidney is in cold storage before it is transplanted. This time is called the CIT and prolonged CIT of more than 12 hours is associated with higher rejection rates, poorer levels of kidney function and lower graft survival rates. As a result, it is imperative that CIT be as short as possible so that patient care and outcomes can be improved.

An audit of CIT between 2010 and 2014 revealed that 48% of cases involved CIT of more than 12 hours. As a result, the renal transplant team embarked on a quality improvement project to reduce the CIT. One of the major factors that affected CIT was the time spent between activating the potential patient and confirming that the patient was fit for transplant surgery. Many of the factors that affected this confirmation time were potentially modifiable with room for improvement.

Using LEAN methodology, the team conducted ground observations and identified waste through value stream mapping. As a result, initiatives that were implemented included reducing dialysis time from 4 hours to 3 hours, tracing case notes via electronic Reaction Monitoring Report (e-RMR) instead of manual fax requests, establishing electronic admission processes in collaboration with the admission and business offices and increasing the frequency of waitlist clinic reviews to eliminate foreseeable case rejections during recipient selection.

By streamlining processes, the team was able to **reduce the proportion of cases with CIT of more than 12 hours from 48.0% to 31.9%**. The **median confirmation time was also reduced from 4.6 hours to 3.7 hours**. These interventions are now embedded in daily work processes and transplant activation protocols. They continue to be reviewed to ensure compliance and sustainability.



## Leveraging New Digital Technology to Improve Donor Recruitment

By SCBB

In October 2019, SCBB introduced DocuSign as part of its Quality Improvement programme to **integrate digital signature technology into its donor recruitment processes**. DocuSign is a technology aide that enables both staff and clients to sign, send and manage documents anywhere on any device securely and confidentially.

Previously, SCBB donor coordinators were only able to meet with an average of 10 maternal donors island-wide at public and private hospitals daily. This model of consent procurement was neither efficient nor cost-effective as manpower and transport costs increased as the number of donors increased. **Since the implementation of DocuSign, digital consent represented 60% of the total consent procured in the last quarter of 2019.** With the time saved through digital consent procurement, donor coordinators were able to conduct daily face-to-face recruitment at KK Women's and Children's Hospital (KKH), SGH and NUH where gynaecologists could refer mothers who were keen on cord blood banking services to SCBB immediately. The increase in productivity has led to a 30% increase in maternal donors recruited in the last quarter of 2019.



# Pursuing Innovation and Research

## 3D-Printed Models for Surgical Planning in Complex Congenital Heart Diseases (CHD)

3D printing and modeling, an emerging advancement in the field of CHD, provides clinicians with a better analysis of complex anatomies to guide surgical strategy, especially in complex CHD cases.

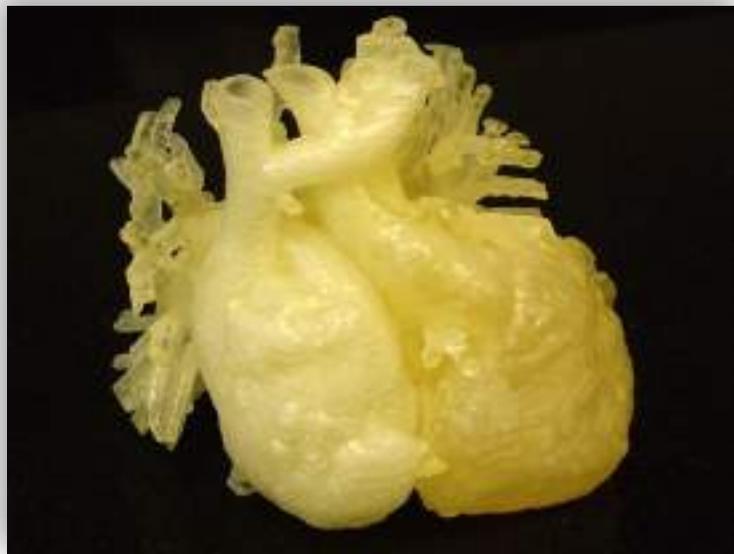
**A 3D-printed model is created based on the anatomical replica of the patient's heart, allowing clinicians to better visualise the intricacies between the different heart structures, thus giving clearer insights into complex pathologies.**

Each CHD patient has a unique heart anatomy. Hence, to minimise errors in clinical judgement, it is crucial for surgeons to see and feel the model on a one-to-one scale to plan and prepare for the best and most appropriate surgery before performing these complex procedures on patients. In addition, the 3D-printed models serve as visual aids which our clinicians can use to help patients and their families understand the surgical procedure that will be performed.

Several publications have validated the use of 3D printing in CHD. Correlation studies also presented good results with anatomical measurements using 3D printing. This technique can therefore be considered reliable with the slight limitation posed by the operator's subjectivity in modelling the defect.

Patients with CHD will be referred for heart transplantation and 3D heart models will be printed to facilitate transplant surgical planning and simulation. This will expand the expertise of the adult heart transplant programme to include patients with complex CHD as well as benefit the team at KKH in developing their paediatric heart transplant programme.

Beyond the clinical purpose in heart transplant programmes, these 3D-printed heart models can potentially be used as educational tools for clinicians and surgeons. Harnessing these developments, the team aspires to be the regional expert in using 3D printing for heart diseases to enable optimal outcomes for patients.



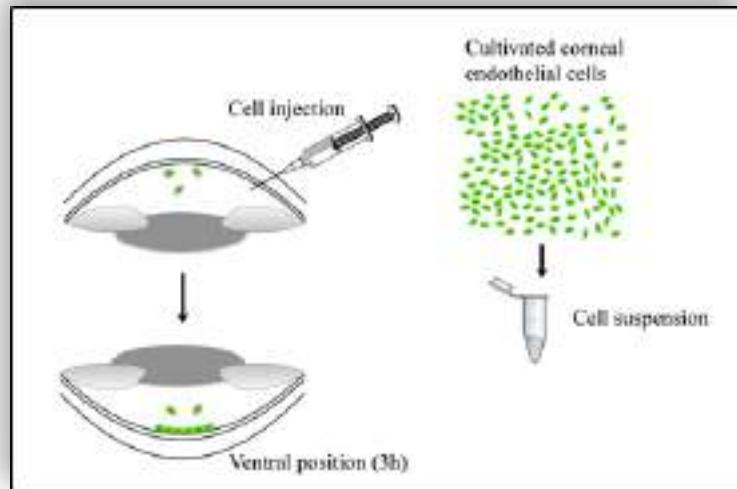
*3D printed models help surgeons optimise surgical plans for complex operations  
Image credit: [www.blog.stratasy.com](http://www.blog.stratasy.com)*

## Cell Therapies for Corneal Endothelial Diseases: A Future Alternative to Corneal Transplantation

The cornea is the transparent structure at the front of the eye. A layer of cells found on the back surface of the cornea, called endothelial cells, maintains corneal clarity. Diseases affecting these endothelial cells can result in loss of vision, and are common reasons for why patients require corneal transplantation. At present, there is a global shortage of suitable donor corneas. This need is driving the search for alternative approaches which are less dependent on donated corneal tissue to treat diseases affecting the corneal endothelium.

**Researchers at SNEC and the Singapore Eye Research Institute (SERI) are evaluating the use of human corneal endothelial cells cultivated in the laboratory for the treatment of corneal endothelial diseases.** Led by Professor Jodhbir Mehta, Head of the Corneal Service and Tissue Engineering & Cell Therapy Department at SNEC / SERI, a team of researchers including Dr Ong Hon Shing, Consultant Ophthalmologist and Dr Gary Peh, Cell Biologist, assessed two techniques for the delivery of cultivated human endothelial cells: cell-injection therapy where cultivated endothelial cells are injected directly into the eye and tissue-engineered endothelial keratoplasty where corneal tissue designed in the laboratory using cultivated endothelial cells is transferred via transplant surgery. **Both techniques were found to be beneficial in restoring corneal endothelium function.** These findings were published in Scientific Reports in 2019.

The success of this pre-clinical study has paved the way for the development of potential cell therapies for corneal endothelial diseases. Researchers at SNEC and SERI are now planning a first-in-man clinical trial to assess the effectiveness of these cultivated endothelial cell therapies on humans.



*Cell injection therapy is a procedure where cultivated endothelial cells are injected directly into the eye*

## Superior Clinical Outcomes of Descemet Membrane Endothelial Keratoplasty (DMEK) over Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) and PK

Since the start of the SNEC Endothelial Keratoplasty (EK) programme in 2006, we have largely transitioned from PK, a technique involving the replacement of the entire cornea to selective lamellar techniques such as DSAEK and DMEK for the treatment of endothelial diseases such as Fuchs' endothelial corneal dystrophy (FECD) and bullous keratopathy (BK).

At present, DMEK is the most advanced EK technique, in which only Descemet membrane and endothelium, without any donor stromal tissue (present in DSAEK), are transplanted. This translates to numerous advantages of DMEK over PK and DSAEK, as demonstrated in our large comparative cohort study from the Singapore Corneal Transplant Registry, published in 2019.

We were able to demonstrate that **patients who underwent DMEK had superior graft survival (97.4%) compared to DSAEK (78.4%) and PK (54.6%) over five years**. This survival advantage was not only evident in patients with FECD, but also in the patients with BK which are more complex cases with poorer prognosis. In terms of complications, the rate of graft rejection and elevated intraocular pressure was lower in DMEK compared to DSAEK and PK for the same indications. In addition, the DMEK cohort also had the fastest visual recovery, with 42.9% of cases achieving a best-corrected visual acuity of 20/25 or better after one year.

With these encouraging clinical results, our centre continues to pursue research and innovation to improve the long-term outcomes for our corneal transplantation patients.



*PK, an "open-sky" full-thickness corneal transplantation procedure*



*DMEK with selective transplantation of donor endothelium and Descemet membrane through a small incision*

## Half-matched Bone Marrow Transplantation and Post-transplant Cyclophosphamide for Treating Patients with Aplastic Anemia

Severe aplastic anaemia is a bone marrow failure syndrome. Traditionally, a bone marrow transplant from a matched donor would be the most optimal treatment.

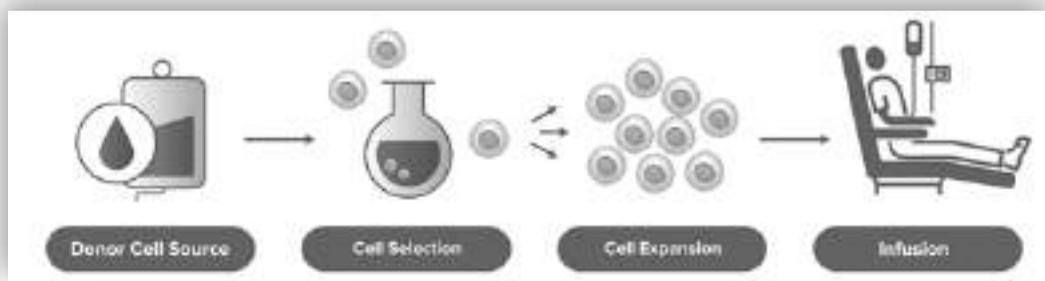
However, in the last decade, haploidentical transplants using bone marrow from half-matched donors have shown promise for the treatment of various blood cancers. To better understand how this method could improve treatment options for severe aplastic anaemia, the Adult Haematopoietic Stem Cells transplant programme in SGH participated in a study by the European Blood and Marrow Transplantation (EBMT). The study analysed data from all acquired aplastic anemia patients who underwent a haploidentical transplantation with post-transplant chemotherapy from 2011 to 2017.

**The study has yielded encouraging results for the combined use of un-manipulated haploidentical donor cells and post-transplant cyclophosphamide in refractory severe aplastic anaemia patients.** This would warrant confirmation with a prospective study involving larger number of patients and longer term follow-up.

## Phase I/II Study of Stem-Cell Transplantation Using a Single Cord Blood Unit Expanded Ex Vivo with Nicotinamide

Umbilical cord blood (UCB) transplantation has a 30-year track record of offering a hematopoietic stem-cell transplant option for patients without an available matched adult donor. UCB transplants offer many advantages. They do not require a perfect Human Leukocyte Antigen (HLA) match, are readily available and have low relapse rates. However, UCB transplant is associated with slow blood count recovery, especially when the cell dose is low.

Findings from this study suggests that **NiCord, an ex vivo expanded cell product, accelerates recovery and shortens the hospitalisation period for patients undergoing a cord blood transplant.** Long term follow-up studies are underway to assess the impact on patient survival rates.



*NiCord is an expanded cell product derived from an UCB  
Image credit: www.sec.gov*

# Fostering a Positive Transplant Culture

## Transplant Awareness Month 2019

Each year, October marks the Transplant Awareness Month. To gather sentiments towards Organ Donation and Transplant, a poll was carried out during roadshows at SGH, National Heart Centre Singapore (NHCS) and KKH. **During the roadshows, the team interviewed 81 members of the public and staff and a total of 156 people participated in the poll**, which was also accessible on the SD Transplant Facebook Page where online participants stood a chance to win prizes. The best performing post reached nearly 7, 100 Facebook users.

The three most common questions from the poll data then formed the pillars of discussion at a luncheon titled **"Untangling Fact from Fiction - Clearing up Misconceptions about Donation & Transplantation"**. The multidisciplinary panel of speakers engaged enthusiastically on questions such as "Can my Next-of-Kin override my decision after my demise?". The conversations considered aspects of consent-taking and legislations in organ donation. The audience raised concerns such as whether pledgers would be prioritised in the waiting list and the speakers succinctly addressed the issue, sharing that strict criteria ensures that Organ Donation and Transplantation continues to provide the gift of life to those in greatest need. This year's luncheon was also graced by Prof Ivy Ng, Group Chief Executive Officer, SingHealth.

The Transplant Awareness Month was also a time to recognise the efforts of our transplant coordinators who play an important role in facilitating the gift of life to transplant patients and their loved ones. The institution celebrated Transplant Coordinators' Day by treating transplant coordinators across NHCS, KKH and SGH to a bento lunch in appreciation of their contributions to organ transplantation at SingHealth.



*Celebrating the efforts towards a successful transplant luncheon in 2019*



*The luncheon features a panel discussion and a live poll to engage audiences*



*Speakers engaged in a panel discussion.*



*The panel discussion included (from left to right): Dr Lee Si Jia, Associate Consultant, Department of Surgical Intensive Care, SGH, Prof Brian Goh, Senior Consultant, Department of Hepato-pancreato-biliary and transplant surgery, SGH, Dr Voo Teck Chuan, Assistant Professor, Centre of Biomedical Ethics, Yong Loo Lin School of Medicine, National University of Singapore, A/Prof Tan Chee Kiat, Director, National Organ Transplant Unit (NOTU), Ministry of Health (MOH), and Ms Sally Kong, Assistant Director, NOTU, MOH*

**We Want To Hear From You!**

Choose 1 question you're most curious about. Comment your thoughts and the best 10 entries will win vouchers!

1 Do we take organs from prisoners?	2 If I am a pledger, will I get priority if I need a transplant?	3 Can animal organs be used for transplants?	4 Can I choose who I want to donate my organs to?
5 Can my next-of-kin overrule my decision after my demise?	6 Will my body be disposed after donating my organs?	7 If I donate my organs, will I've conditions be screened?	8 Can a brain dead patient recover from their injuries?

Correct ends 6th October 2019

*The poll was conducted on Facebook*

## Singapore Transplant Games (STG) 2019

On 23 February 2019, the Society of Transplant Singapore organised the biennial STG, **bringing together 190 transplant patients and caregivers, and 96 staff volunteers across five transplant programmes.** The Guest-of-Honour was A/Prof Kenneth Mak, then-Deputy Director of Medical Services (Health Services Group), MOH. This sporting event celebrated the gift of new life and strength that patients receive after organ transplantation. Competitors who excelled at the STG also had the opportunity to represent Singapore in the next World Transplant Games.

In addition to competitive sports, there were also activities for the whole family such as carnival games and snacks, educational talks and booths set up by Allied Health Professionals and external partners. Staff across all transplant programmes and wards generously volunteered their time to support the event and ensured that all activities ran smoothly. We received positive feedback from the participants who were happy to have had the chance to bond with fellow patients and healthcare staff outside of the clinical setting. At the next instalment of STG in 2021, we hope to reach out to a wider transplant community and advocate healthy and active living.



*The attendees and helpers of the STG 2019*



*A/Prof Kenneth Mak, A/Prof Terence Kee and Prof A Vathsala joining the group for warm-up exercises*



*All attendees gather for a warm-up before the games begin*

## Celebrating the Contributions of Transplant Staff

Behind every transplant stands a multi-disciplinary team of healthcare professionals. The Transplant Appreciation Ceremony is organised annually for healthcare professionals to come together as one transplant family to celebrate the dedication and contributions towards transplant care. In his opening address, Prof Ng Wai Hoe, former Deputy Group Chairman, Medical Board, SingHealth, gave examples of projects that were made possible through collaboration and pooling of resources among various transplant programmes and departments in SingHealth. He looked forward to more advancements in transplantation to improve patient care. **Thirteen staff received awards at the ceremony in recognition of their exemplary contributions towards patient care.**



*Decorative wall in recognition of the award winners of the Transplant Appreciation Ceremony*



*Prof Ng Wai Hoe addressing the audience at the ceremony*



*Award winners of the Transplant Appreciation Ceremony*

## NOTU holds its Third Annual Wellness Carnival

SD Transplant Centre participated in the NOTU's Wellness Carnival 2019 held in Yishun. The event was graced by A/Prof Muhammad Faishal Ibrahim, former then-Parliamentary Secretary, Ministry of Social and Family Development and Ministry of Education, Member of Parliament for Nee Soon GRC. In its third iteration, the event continued the national effort by all healthcare partners such as Health Promotion Board, Singapore Red Cross and Youth Corps Singapore to raise public awareness on organ donation. We engaged with members of the public to help them understand what organ donation was about and addressed any questions they had. We also encouraged the public to bring this knowledge home to share with their families. Building on previous years' positive feedback on **using postcards to remind participants on speaking to their families about organ donation**, we replicated the campaign with a newly-designed postcard to depict the centre's new name. Approximately 6,200 attendees benefited from the day-long programme.



*Cards given to members of the public to encourage them to speak to their loved ones about organ donation*



*Then-Senior Parliamentary Secretary, Assoc Prof Muhammad Faishal Ibrahim poses for a photo with transplant coordinators and clinicians at the booth*



*A coordinator explaining to a member of the public on the postcards used at the booth*

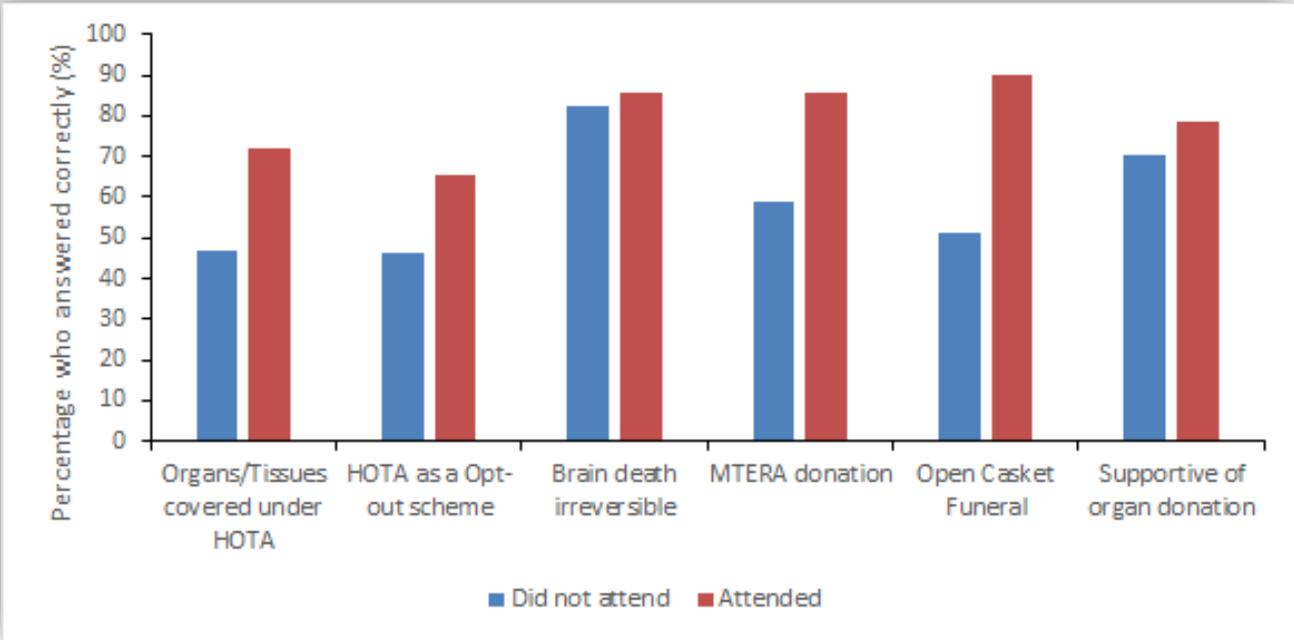


*At the carnival, the aim was to encourage the public to speak to their loved ones about organ donation*

### Measuring the effectiveness of Transplant Awareness Talks among SingHealth staff

The SD Transplant Centre proactively conducts transplant awareness talks for internal staff to increase their knowledge and correct misconceptions. These efforts serve to foster a positive attitude and understanding towards organ donation and transplantation. To assess the success of these talks, a retrospective cross-sectional study was conducted using data collected from a quantitative and anonymous survey between February 2016 and March 2019. The results of 2,356 participants who did not attend the awareness talks were compared with 2,440 participants who did. The key finding revealed that **participants who attended talks showed that they had better knowledge and improved attitude towards organ donation.**

These findings were presented at the Society of Transplantation Annual Scientific Meeting 2019 and the Asia Pacific Medical Education Conference 2020. With these results, the Centre is encouraged to continue its education and outreach efforts and will explore areas of improvement such as creating resources that are easy to understand so that information on legislation can be easily disseminated.



Graph depicting findings of the Transplant Awareness Talks

# Education and Engaging Advocates

## Inaugural SD Transplant Centre Symposium 2019

The **inaugural SD Transplant Centre Symposium** took place from 20 – 21 September 2019 together with the SingHealth Duke-NUS Surgical and Anaesthesia Congress (SAC) 2019. The two-day symposium at Academia featured a lecture series presented by foreign and local speakers as well as two Transplant Surgical Workshops - the Kidney and Liver Transplant Surgical Workshop and the Abdominal Wall and Intestinal Transplant Workshop.

The **Abdominal Wall and Intestinal Transplant Workshop** saw 11 participants from different local institutions and visitors from Sri Lanka. Assoc Prof Tan Bien Keem, Senior Consultant, Department of Plastic, Reconstructive and Anesthesia Surgery, SGH and Assoc Prof Prema Raj, Senior Consultant, Department of Hepato-pancreto-biliary and Transplant Surgery, SGH carried out the workshop with, Prof Detlev Erdmann, Professor of Surgery, Plastic and reconstructive surgeon from Duke University Medical Centre. They demonstrated how the application of abdominal wall transplant supported intestinal transplant. Bowel swelling and the attendant risk of abdominal wall dehiscence are mitigated by increased abdominal capacity provided by the presence of an abdominal wall flap.

On the **first day**, the Transplant Symposium drew 120 participants. Building on the expansion of our transplant services, **Prof Detlev Erdmann and Prof Debra L. Sudan, Chief, Division of Abdominal Transplant Surgery, Duke University Medical Centre** shared on their Duke experience with multi-visceral transplantation. Asst. Prof Tsutomu Inatomi, Department of Ophthalmology, Kyoto Prefectural University of Medicine spoke on the developments in cell-based therapy for ocular surface reconstruction. Taking on an alternative perspective, Ms Debra S Bernardina, Liver Manager, Heart and Lung Transplant Programme, on a transplant coordinator's perspective to actualise successful transplants.

On the second day, **Prof Julia Wendon, Consultant Intensive Care and Hepatologist, King's College Hospital**, illuminated the audience on the peri-operative care in Liver Failure patients. The **Kidney and Liver Transplant Surgical Workshop** led by Dr Valerie Gan, Consultant, Urology, SGH and Dr Tan Ek Khoon, Consultant, Department of Hepato-pancreto-biliary, SGH was held on the same day and attracted 25 participants. They learnt about the surgical aspects of living and deceased donor organ retrieval and recipient organ transplantation.

The wealth of knowledge shared during the symposium and the discussions sparked from the interactions at the lectures and workshops made the event a success. The symposium was a big first step for SD Transplant Centre in its initiatives to support transplant education and research. The centre has high hopes to replicate this event again with greater participation and impact on the transplant community as a whole.



*Transplant colleagues from KKH attending the lectures. The symposium saw attendance from clinicians, nurses and allied health professionals.*



*Prof Detlev Erdmann, Professor of Surgery, Plastic and reconstructive surgeon from Duke University Medical Centre presenting on Abdominal Wall Transplantation*



*(Left) Dr Siva and (Right) Dr Budhi, a fellow cardiac surgeon invited from Indonesia*



*(6th from the left) Prof Debra L. Sudan, Chief, Division of Abdominal Transplant Surgery, Duke University Medical Centre and the organising committee of the 2019 SingHealth Duke-NUS Surgical & Anaesthesia Congress*

### 3<sup>rd</sup> Biennial Asia Pacific Mechanical Circulatory Support Conference (APACMCS) 2019

The 3<sup>rd</sup> Biennial APACMCS was successfully held at NHCS from 1 - 2 November 2019. Endorsed by the ISHLT, the conference achieved its two key objectives of:

- (1) Providing leadership in the field of heart and lung transplantation and Mechanical Cardiac Support (MCS) by developing relationships with regional societies and promoting ISHLT's international outreach programmes including educational activities and membership
- (2) Establishing a regional MCS teaching centre to provide advanced learning opportunities for MCS, heart and lung transplant specialists in order to nurture experts in the Asia Pacific region.

The **event attracted 223 participants from 19 countries**. There were 35 invited speakers including 26 overseas speakers from Australia, Czech Republic, Germany, Hong Kong, India, Japan, South Korea, Saudi Arabia, Taiwan and USA. The discussions were well-received by both overseas and local delegates.

The highlight of this year's conference was the lunch symposium and **Heart Failure Workshop that was streamed 'live'** for the benefit of clinicians who were unable to join the physical conference due to clinical commitments. The symposium also featured two clinicians who presented from Taiwan via webcam. This was the first time a live-streaming session was held at an APAC MCS conference. The session, held in collaboration with Abbott, provided an excellent two-way interactive platform for exchanges beyond the conference's physical venue in Singapore.



*Interactions at the Exhibition Hall, NHCS*



*3<sup>rd</sup> APACMCS 2019 faculty*



*Strong attendance at didactic lectures held at the NHCS Auditorium*



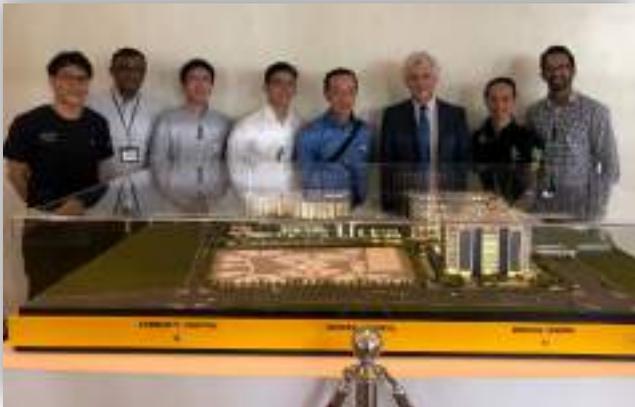
*Foreign and local panelists engaged in discussion*

## Liver Transplantation Expert Prof Nigel Heaton's visit at SingHealth

SingHealth Liver Transplant Programme was proud to host the **MOH's Health Manpower Development Plan (HMDP) expert Prof Nigel Heaton from King's College Hospital, London**. Prof Heaton has been the Head of Liver transplantation at King's College Hospital for more than 20 years, and is an adult and paediatric transplant and Hepato-pancreato-biliary surgeon. His unit has performed an impressive 5,000 liver transplants over 25 years.

During his three-day visit, Prof Heaton imparted valuable knowledge through his interactions with healthcare professionals from SGH, KKH, CGH and SKH. Prof Heaton highlighted key areas for improvement in Donation after Brain Death (DBD) such as engaging the Spanish organ donation team to model their system while recognising the local challenges. With Donation after DCD making up a significant portion of organ transplantations in the United Kingdom (UK), he was able to share in great detail their experience on the topic. Prof Heaton also gave valuable recommendations on improving transplantation services, such as developing new technologies in machine perfusion to support DCD in aspects of optimising donor grafts.

Prof Heaton's visit also included lectures and case discussions on liver transplantation, intestinal and multi-visceral transplantation. The liver transplant team had the opportunity to engage in discussions with Prof Heaton on the development of a multi-visceral transplantation programme to explore the potential of expanding transplant services at SingHealth.



*Prof Heaton visits SKH. He also gave lectures and interacted with the transplant professionals.*



*Prof Heaton speaks with Dr Tousif Kabir, Consultant, Hepato-pancreato-biliary Service, SKH, as he visits the wards*

## Renal Fellowship Programme Launched to Expand the Region's Capabilities in Renal Transplant

Apart from excellence in clinical services and performing groundbreaking research into newer transplant-related diagnostics and therapeutics, the renal transplant programme at the SGH aims to share its expertise and experience with practitioners in the region who aspire to set up their own renal transplant programmes or enhance existing ones.

To achieve this vision, the renal transplant programme has developed a twelve-month fellowship that offers training to overseas nephrologists, which in turn would help to develop a regional network of partners for future collaboration on research and education. During the training, the fellow will be an integral part of the renal transplant team and will be involved in all aspects of care and operations. The fellow will also be required to sit for an exit examination and complete a research project to be published by the end of the fellowship.

## Transplant Surgery Fellowship at the Prestigious Mayo Clinic Opens New Opportunities for International Collaboration

Dr Tan Ek Khoon, Consultant, Department of Hepato-pancreato-biliary and transplant surgery, SGH, was selected to attend a highly-competitive two-year **Abdominal Transplant Surgery Fellowship at the prestigious Mayo Clinic in Rochester, Minnesota USA**. Accredited by the American Society of Transplant Surgeons, the programme allowed Dr Tan to achieve an operative log of 53 liver transplants, 132 kidney transplants (excluding SPK and simultaneous liver-kidney transplants), 9 pancreas transplants, 78 donor procurements, 60 living donor nephrectomies and a dozen complex hepato-pancreato-biliary cases. His clinical exposure would equate to four times the above numbers.

Having participated in the first simultaneous double-lung and liver transplant at the Mayo Clinic, Dr Tan shared about the comprehensive training he received. "The experience gained was robust, not only allowing me to be comfortable in performing liver, kidney and pancreas transplants, but also in managing the surgical complications. The well-rounded training structure allowed me to become adept at the medical aspects of transplantation and transplant immunology. I had time to engage in meaningful clinical research, half of which have reached publication. I've also been able to learn specific skills such as operative techniques and approaches to complex cases, and operative volume which the local setting could not afford."

According to Dr Tan, what attracted him to Mayo Clinic was their focus on collaboration and how the centre was motivated to improving patient care. "Being an alumnus now provides opportunities to continue international collaborative efforts with them," he said.

The programme at Mayo Clinic inculcated the importance of multi-disciplinary support and collaboration in hospitals to deliver high quality, complex medical care especially in transplant. Dr Tan added that this is something he intends to pursue - building a strong team to push the frontiers of hepato-pancreato-biliary and transplant surgery. Potential future collaborative efforts could include transplant research for cholangiocarcinoma (bile duct cancer), for which the Mayo Clinic is a pioneer.



*Dr Tan poses with the transplant surgeons from Mayo Clinic he interacted with during his fellowship - (From Left) Dr Mikel Prieto, Dr Julie Heimbach, Dr Scott Nyberg, Dr Charles Rosen, Dr Timucin Taner*



*Dr Tan with Dr Patrick Dean, Surgical Director of Kidney Transplantation and fellowship programme director*



*Dr Mark Stegall, Director of Transplant Immunology Programme and Dr Tan Ek Khoon*

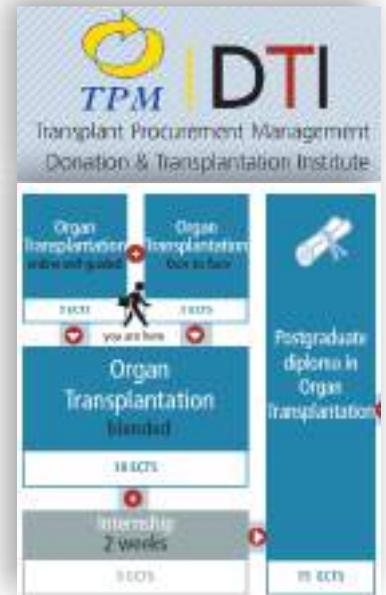


*Dr Tan with Dr David Nagorney, Hepato-pancreato-biliary Surgeon*

## Building Expertise in Organ Transplantation and Procurement

During the first half of 2019, four coordinators from the SD Transplant Centre went to Barcelona, Spain, to complete their **Postgraduate Diploma in Organ Procurement and Transplantation** organised by the Transplant Procurement Management (TPM) – Donation and Transplantation Institute (DTI). This was an important step in raising the level of expertise in transplant coordinators to become specialists and to develop them further to become trainers.

Having done their online training in 2018, the transplant coordinators spent three weeks undergoing a face-to-face training course and an internship at the Clinical and Provincial Hospital of Barcelona to learn more about their workflows and practices. Our transplant coordinators share their learning experience below:



### Ms. Ma Qian, Senior Manager, Liver Transplant Unit, SGH

I was assigned to observe various doctors, transplant coordinators and nurses involved in liver transplant. Although their roles in the transplant journey is segmented, their care towards patients remained detailed and thorough. I was given the opportunity to observe a combined heart-and-liver transplant. From this, I saw how they carried out detailed assessments, provided timely treatment to patients at the outpatient clinics and inpatient wards as well as how they managed their Donation after Cardiac Death workflow.

### Ms. Constance, Transplant Coordinator, Renal Transplant Programme, SGH

During my observation of a renal transplant surgery, I asked about the machine used to store the donor kidney. The machine called WAVES is a transportable, self-contained kidney preservation system designed to support static monitoring and transportation of kidneys. The surgeon shared that, to maintain organ quality, the priorities are to minimise enzymatic activity, preserve tissue viability and minimise reperfusion injury. As the need for renal transplantation is increasing and the donor pool remains too small to meet the demand, the scarcity has led to the use of expanded criteria donor organs. Perfusion machines are being employed to improve the quality of transplanted kidneys, thereby achieving better surgical outcomes.

**Mr. Aloysius Seah, Senior Transplant Coordinator, SD Transplant Centre, SingHealth**

Barcelona and Singapore face similar challenges in organ donation with the primary challenge being resistance by families towards organ donation. Despite these challenges, Barcelona has been able to achieve success in their organ donation programmes. It is encouraging to know that with a targeted initiative to address challenges, Singapore too can achieve the same success. Aside from training transplant coordinators to upgrade their skills, it is also important to create teaching material for doctors and nurses to help inculcate a transplant-positive culture in the institution.

**Ms. Sharon Neo, Principal Clinical Co-ordinator, Mechanical Circulatory Support, Heart-Lung Unit, NHCS**

I had the opportunity to observe transplant surgeries and join my mentor and team in pre and post-transplant clinical activities such as daily in-patient clinical case discussions, ward rounds, heart transplant clinics, journal clubs and rehabilitation programmes. As with NHCS, they followed the guidelines of the ISHLT in their care of heart transplant candidates.

## Developing Skills in Corneal Transplant Professionals

### Advanced Corneal Surgery ALK / DSAEK / DMEK Course

The SNEC organised a **three-day course for corneal surgeons and general ophthalmologists in the surgical and medical management of corneal transplant patients**. The course comprised of didactic lectures, hands-on wet lab sessions, a 'live' surgery and clinical case presentations to provide practical insights for delegates. Held at SNEC at least once a year, the course was well attended by both local and overseas ophthalmologists.



*Prof Jodhbir conducting the course presentation*



*Participants, guided by SNEC's corneal surgeons, engaged in the hands-on practice of one of the surgical techniques.*



*Local and foreign delegates who attended the Advanced Corneal Surgery ALK / DSAEK / DMEK Course*

### SEB's 31<sup>st</sup> and 32<sup>nd</sup> Cornea Procurement Accreditation Course

Organised and helmed by SEB's team of Eye Donation Counsellors and Tissue Coordinators, **this course aims to equip Residents and Medical Officers with an overview of the role SEB plays in supporting cornea transplant in Singapore**. The course covered relevant legislations and provided its participants with a comprehensive knowledge of cornea donor screening and medical guidance as well as a wet lab session on corneal retrieval techniques. Dr Anshu Arundhati, Clinical Director, SEB, spoke at the 31<sup>st</sup> Cornea Procurement Accreditation Course.

Participants of this course were qualified to conduct corneal recovery and their names were submitted to MOH for inclusion in the Gazette, allowing them to screen and retrieve donors' corneas at their respective hospitals.



*Senior Tissue Coordinator Darren Sai guiding participants in corneal recovery*



*Participants of the SEB 32<sup>nd</sup> Cornea Procurement Accreditation Course*

# Revolutionising Transplant and Beyond

## Beyond Liver Transplantation

Intestinal Transplantation (ITx) and Multivisceral Transplantation (MVT) as a life-saving procedure have not been widely made known as potential options to healthcare professionals or patients in Singapore.

Over two decades of clinical experience in the USA and UK have presented very promising results. These countries have shown that **ITx and MVT are feasible, life-saving treatment options for patients in Singapore, who will otherwise face a very grim prognosis with the limited treatments available currently.**

In Singapore, treatment options are limited for adult and paediatric patients with poor intestinal function not responding to standard therapy such as parenteral nutrition therapy, and develop serious complications related to their intestinal failure. In addition, another group of patients with terminal conditions not amenable to other medical therapies such as tumours (desmoid tumours) in the abdomen are amenable to MVT.

The development of a new transplant service will involve a multidisciplinary team of experienced and dedicated clinicians, nurses and allied health professionals. Committed gastroenterologists and hepato-pancreato-biliary surgeons in SingHealth underwent clinical fellowships to equip themselves with hands-on management of pre, peri and post-transplant patients. Both adult and paediatric teams in SingHealth are building on the experience of these US and UK centres to create an intestinal rehabilitation and transplant programme that can deliver high quality and value-added care for our patients. The development of MVT programme will leverage on prevailing expertise that exists today for organ donation and transplantation.

**We have had training and partnership opportunities with experienced international centres such as Duke Transplant Centre, Cambridge University Hospital and King's College Hospital.** We have invited experts Professor Debra Sudan from Duke Transplant Centre and Professor Nigel Heaton from King's College, who generously shared their knowledge and experience in the development of the MVT service. These initiatives are vital for our transplant team to hone the skills to carry out this complex transplantation.

There are several research projects underway that aims to understand the peri-operative planning and processes behind MVT and the ability to reliably achieve immunological tolerance in organ transplantation. We will leverage on our capability in such research work to achieve better clinical outcomes and deliver quality care in MVT. The advancement in the multi-organ and liver transplant field is made possible with the support of SingHealth Duke-Transplant Centre – John 3:16 MVT Fund.

With a vision of developing multi-organ transplantation research in SingHealth, a philanthropic contribution allowed us to set up the John 3:16 Multivisceral Transplant (MVT) Fund in 2018.

We are also extremely privileged to have had the Lee Foundation Funds that supported our efforts since 2010.

Philanthropic contributions are essential to the SD Transplant Centre's strategy of continuous improvement to meet our patient needs.



*Case discussion with transplant teams from SGH and KKH*



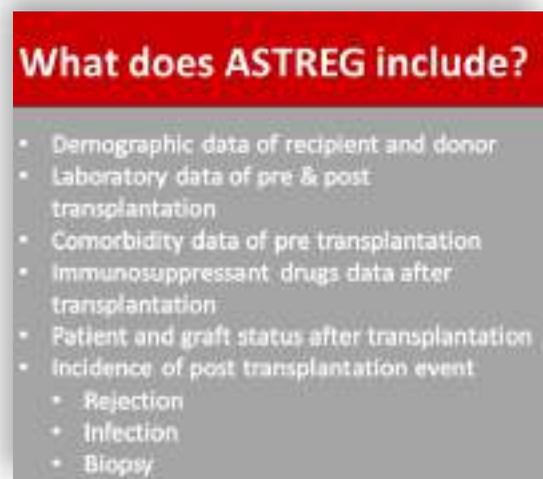
*Dr Debra Sudan delivering a keynote lecture at the SD Transplant Centre Symposium in September 2019*

## Participating in the Asian Organ Transplantation Registry (ASTREG)

At the last Council Meeting of the Asian Society of Transplantation in New Delhi, India, last year, A/Prof Terence Kee who represented Singapore at the Council in his capacity as President of the Society of Transplantation (Singapore) was nominated to be one of the Asian leaders to spearhead the running of an ASTREG.

ASTREG is the brain child of the Asian Society of Transplantation and has been set up with the assistance of the Korean Transplantation Registry in 2018. **The Registry will be an important tool to enable the collation of data for transplantation activities and clinical outcomes in the region, which can subsequently become the bedrock for Asian Transplant Centres to collaborate and embark on research projects that could improve the outcomes of Asian transplant recipients.**

The SD Transplant Centre is keen to participate in this ASTREG and is in the midst of finalising a data sharing agreement with the ASTREG.



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## STR Bio-banking Services

STR facilitates basic, translational and clinical research at SingHealth and the Duke-NUS Medical School. Headed by a pathologist and guided by the STR committee, STR aims to provide a well-managed tissue repository for all researchers in Singapore through proper harvesting, processing and storing of bio-specimens. By providing quality and internationally accredited tissue banking services, STR promotes collaboration between researchers in the SD Academic Medical Centre and abroad.

The SD Transplant Centre is collaborating with STR to utilise its unscheduled collection bio-banking services to **deposit bio-specimens recovered from consenting patients** undergoing transplant surgery. The specimens that are deposited **can be used by medical teams for future transplant-related research** to better understand certain transplant conditions and improve patients' treatment outcomes and care.

# Transplant Programme Reports

## Liver Transplant Programme

	1-year		3-year		5-year
	Deceased donor	Living donor	Deceased donor	Living donor	Deceased donor
<b>SGH Patient Survival - 2006-2019</b>	91.7%	80.5%	89.2%	68.2%	87.6%
<b>International Benchmarks</b>	>90.7% <sup>1</sup>	>88.0% <sup>3</sup>	>84.0% <sup>1</sup>	>83.0% <sup>3</sup>	>81.0% <sup>2</sup>
<b>SGH Graft Survival (censored for death) - 2006-2019</b>	95.8%	87.8%	95.8%	84.8%	95.8%
<b>International Benchmarks</b>	>85.0% <sup>1</sup>	>78.0% <sup>3</sup>	>83.0% <sup>1</sup>	>72.0% <sup>3</sup>	>75.0% <sup>2</sup>
<b>SGH Patient Survival - 2015-2019</b>	92.0%	100%	88.3%	88.9%	
<b>International Benchmarks</b>	>90.7% <sup>1</sup>	>88.0% <sup>3</sup>	>84.0% <sup>1</sup>	>83.0% <sup>3</sup>	
<b>SGH Graft Survival (censored for death) - 2015-2019</b>	97.4%	100%	97.4%	100%	
<b>International Benchmarks</b>	>85.0% <sup>1</sup>	>78.0% <sup>3</sup>	>83.0% <sup>1</sup>	>72.0% <sup>3</sup>	

### International Benchmarks

<sup>1</sup> Organ Procurement and Transplantation Network (OPTN)/ Scientific Registry of Transplant Recipients (SRTR) 2018 Annual Data Report: Liver

<sup>2</sup> National Health Service (NHS) Blood and Transplant Annual Report 2017/2018: Liver Transplantation

<sup>3</sup> Living donor liver transplantation in Europe HepatoBiliary Surg Nutr 2016;5(2):159-175.

International benchmarks for graft survival were not censored for death.

### Quality

To align with the modified Montgomery Test, Liver Transplant **improved process of two-point consent-taking** for patients on waitlist.

Liver transplant hepatologist, Dr Thinesh Lee Krishnamoorthy, championed the initiative of **expanding liver transplantation using Hepatitis B infected liver** through MOH Sub-committee on liver transplantation.

### Clinical Services

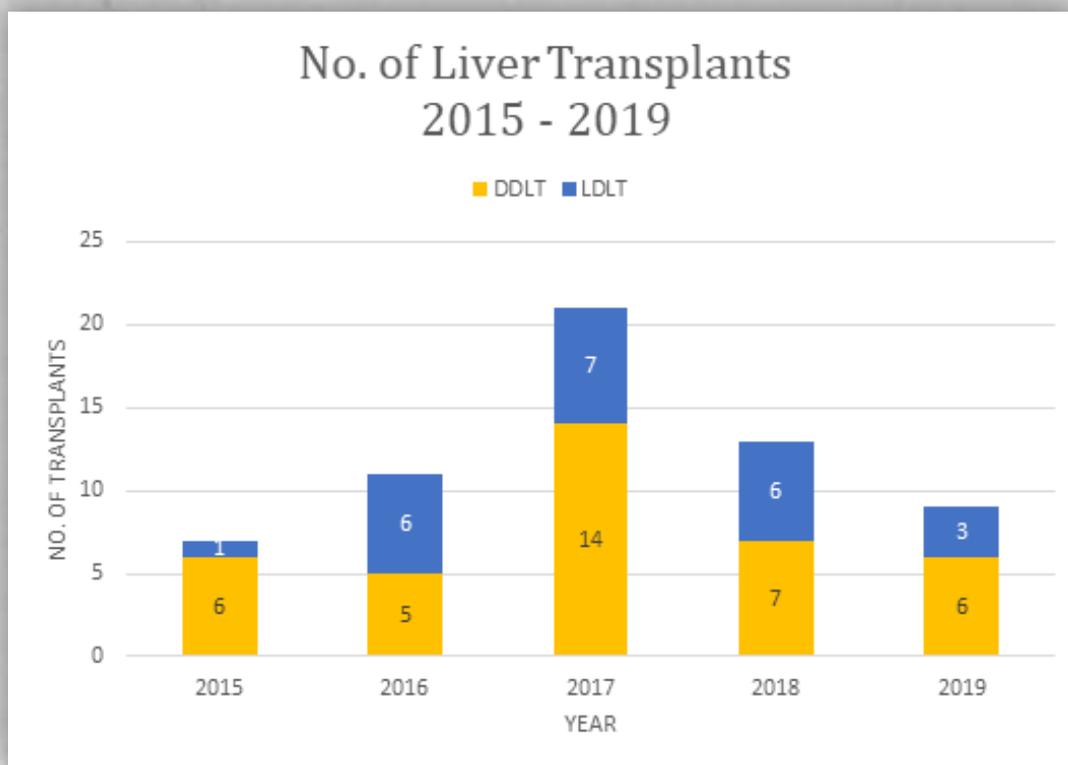
Started **living donor hepatectomy using minimally invasive laparoscopic techniques** instead of standard open surgery, resulting in shorter recovery time for all living donors.

### Future

In SGH and KKH, surgeons, gastroenterologists and other key specialties are working together to **develop a MVT service in Singapore** to provide life-saving transplant treatment to intestinal failure patients.

Enabling patients and **increasing accessibility of care in community through primary care providers** by:

1. Empowering transplanted patients to take charge of their own healthcare e.g. for common ailments, vaccinations.
2. Decrease hospital visits for transplant patient.



### Research

**7 specimens of transplanted patients banked**

Started bio-banking of blood specimens at STR for liver transplant patients to create a repository of liver transplanted patients for potential future clinical and research purposes.

**5 Research Publications**

**5 Oral / Poster Presentations**

**Education & Training**

**International Exposure & Experience**

**7 clinicians**

Embarked on a 2-week study trip at Addenbrooke's Hospital in Cambridge, UK to gather new insights on clinical management, immunosuppression management and surgical approach to MVT.

**2 transplant coordinators**

Attended 7<sup>th</sup> Biennial Congress of the Asian-Pacific Hepato-Pancreato-Biliary Association (A-PPHBA 2019) in September 2019, with support of LFG, and the International Congress of the Intestinal Rehabilitation and Transplant Association 2019.

**2 surgeons**

Awarded HMDP Clinical Fellowships for abdominal organ transplantation at Mayo Clinic and Addenbrooke's Hospital.

Transplant Coordinator trained under TPM DTI in Barcelona and obtained **Postgraduate diploma in Organ Procurement / Transplantation.**

**Learning from Experts**

**MOH FY18 HMDP Visiting Expert Programme with Prof Nigel Heaton**, Professor of Transplant Surgery, Liver Transplantation, Kings College London on liver and multi-visceral transplantation, and DCD.

**Prof Julia Wendon, Critical Care Physician, Kings College London**

**Prof Debra Sudan, Chief of the Division of Abdominal Transplant, Duke University Medical Center**

Visiting experts invited to be a part of SD Transplant Centre Symposium 2019 to improve local medical professionals' expertise in the field of liver transplant, MVT, and critical care in liver and liver transplantation.

**Going beyond borders**

Hosted academic exchange at **Shanghai, Renji Hospital**

A/Prof Prema Raj, spoke at **Shanghai 2019 Asian Medical Week**

Broadened the team's peer-to-peer connections in the region and built on opportunities for future collaboration.

One-week comprehensive training programme for **Kandy Teaching Hospital, Sri Lanka** that covers key liver transplant specialties and surgical workshop

Collaborated with SingHealth International Collaboration Office to organise a Liver Transplant Training Programme to grow SD Transplant Centre's standing as a training and academic centre in the region.

**Programme Efforts**

Collaborated with SingHealth Alice Lee Institute of Advanced Nursing to deliver **a lecture on liver transplantation during the Organ Transplant Nursing Course** in 2019.

## Renal Transplant Programme

	1-year		5-year	
	Deceased donor	Living donor	Deceased donor	Living donor
<b>SGH Patient Survival - 1-year survival, 2018; 5-year survival, 2016</b>	100%	100%	100%	100%
<b>International Benchmarks</b>	97.0% <sup>1</sup>	100% <sup>1</sup>	91.0% <sup>1</sup>	96.0% <sup>1</sup>
	97.0% <sup>2</sup>	99.0% <sup>2</sup>	97.0% <sup>2</sup>	94.0% <sup>2</sup>
	96.3% <sup>3</sup>	98.8% <sup>3</sup>	83.2% <sup>3</sup>	92.1% <sup>3</sup>
<b>SGH Graft Survival (not censored for death) - 1-year survival, 2018; 5-year survival, 2016</b>	100%	100%	94.7%	100%
<b>International Benchmarks</b>	94.0% <sup>1</sup>	99.0% <sup>1</sup>	84.0% <sup>1</sup>	89.0% <sup>1</sup>
	94.0% <sup>2</sup>	98.0% <sup>2</sup>	86.0% <sup>2</sup>	93.0% <sup>2</sup>
	93.2% <sup>3</sup>	97.5% <sup>3</sup>	74.4% <sup>3</sup>	85.6% <sup>3</sup>

### International Benchmarks

<sup>1</sup> Australia and New Zealand (ANZ) Dialysis and Transplant Registry 41<sup>st</sup> Report

<sup>2</sup> National Health Service (NHS) Annual Report 2017/2018 on kidney transplantation

<sup>3</sup> Organ Procurement and Transplantation Network (OPTN) National Data Report on kidney transplantation

### Quality



Implemented a quality improvement project on reducing CIT by shortening the time between recipient activation and transplant surgery. This project was selected as a finalist for SGH Quality Improvement Project of the Year Award.

The proportion of cases with CIT of more than 12 hours was **reduced from 48.0% (in 2010 to 2014) to 31.9% (<period to be defined>)**. The median confirmation time was also **reduced from 4.6 hours to 3.7 hours**.

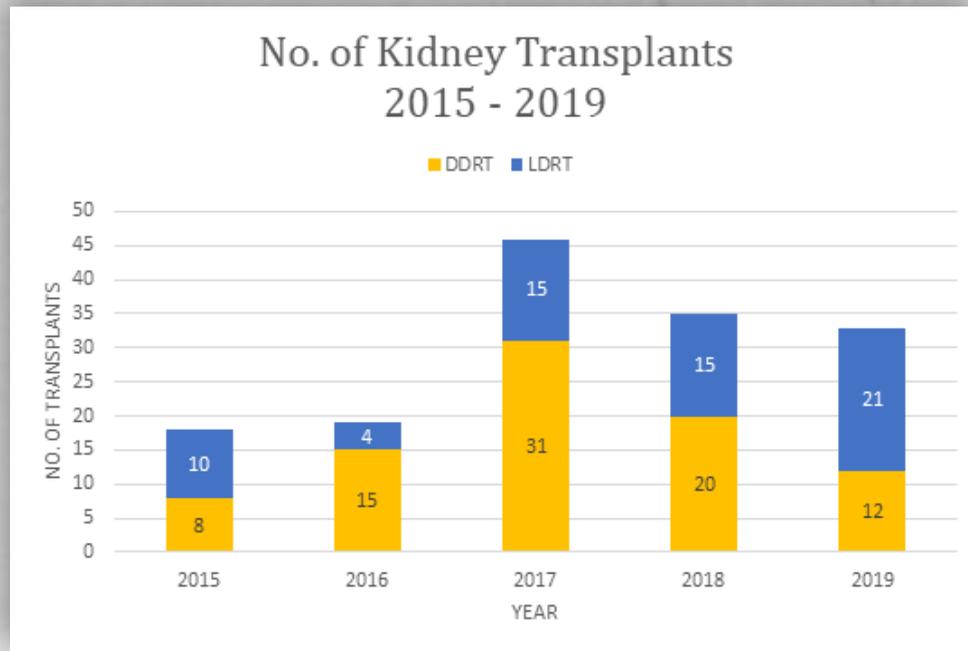
### Clinical Services

**October 2019**

For wait-list counselling, a lean National Transplant Registry System (NTRS) registration process was introduced to improve the total number of patients on NTRS.

**June 2019**

Introduced the Electronic Referral System which simplified the process by tracking transplant referrals.



#### New Research

**Funding Body:** LFG

**Title of Project:** Cytolytic anti-BK T-cell isolation and expansion

**Objective:** Study to determine if enough anti-BKV T-cells can be generated. Foundation of future clinical trial to study efficacy of anti-BKV T-cells to treat BKV infections.

**4 Research Publications**

**4 Oral / Poster Presentations**

#### Education & Training

**55 patients**

Attended lectures organised at NKF patient education symposium to improve transplant awareness and knowledge to patients in the community.

**42 dialysis nurses**

Participated in a pilot outreach training programme with NKF featuring a didactic lecture to raise awareness of kidney transplant amongst NKF nurses.

**100 participants**

Attended the 4<sup>th</sup> patient lecture and dinner symposium, an event to provide a programme update to patients and families. It was also an educational session on exercise and healthy living. This event was also aimed to promoting the kidney transplant support group.

**Extended transplant education to non-SGH patients** by organising education sessions at CGH in February 2019, to create awareness and knowledge on kidney transplantation.

One pre-transplant coordinator trained under TPM DTI and **achieved Postgraduate Diploma course in Organ Transplantation.**

## Heart Transplant Programme

	1-year	5-year	10-year
<b>NHCS Patient Survival - Heart, 1990-2019</b>	77.3%	68.8%	54.9%
<b>International Benchmark</b>	83.7% <sup>1</sup>	72.4% <sup>1</sup>	58.1% <sup>1</sup>

	1-year	3-year	5-year
<b>NHCS Patient Survival - Left ventricular assist device (LVAD), 2009-2019</b>	88.2%	80.2%	75.8%
<b>International Benchmark</b>	83% <sup>2</sup>	63% <sup>2</sup>	46% <sup>2</sup>

### International Benchmarks

<sup>1</sup> International Society for Heart and Lung Transplantation (ISHLT) Registry

<sup>2</sup> Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) Registry

### Quality

#### Methods

#### Aims and/or Outcomes

Conducted regular clinical case presentations and discussions.

Review and update existing clinical practices to optimise clinical outcomes.

On-going collaborative study with the Chinese University of Hong Kong on "Testing the Psychometric Properties of the Chinese LVAD Self-Efficiency Scale and LVAD Home Management Adherence Scale in Patients with LVAD and their caregivers".

Learn more about the needs of patients with LVAD and their caregivers to provide better care and improve overall well-being.

Enrolled in the study amendment for an international commercial trial of HeartMate 3™ Registry to include up to 5 years of follow-up.

Evaluate the HeartMate 3™ with Full Maglev Technology in a Post-Market Approval Setting (ELEVATE™) to compare the pre-market to post-market long term outcome.

Active participation in the ISHLT registry for IMACS.

Evaluate the outcomes of VDA patients at NHCS, and to benchmark against international centres  
*\*IMACS was temporarily put on hold since mid-2009 to assess its compliance with the European Union's GDPR and to also review changes to expand the data fields to improve the efficiency of the data submission process.*

### Clinical Services

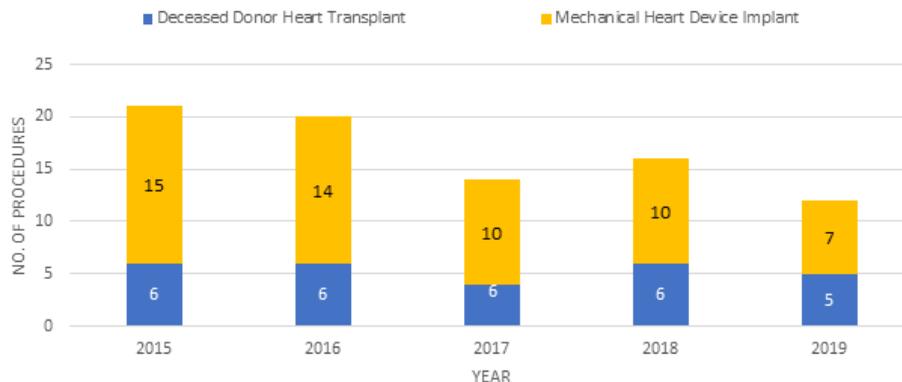
**Longest ongoing LVAD support patient (<10.5 years)** in Asia Pacific.

#### Future

Research outcomes on patients with advanced heart failure or VAD and their caregivers revealed challenges and unmet supportive care needs. The programme aims **to design a new model of care for LVAD patients in collaboration with the Palliative Care team and medical social workers.**

As part of continuous efforts for clinical practice improvement, the programme aims to **establish a task force to explore the various measures for LVAD driveline infection control and prevention.**

### No. of Heart Transplants & Mechanical Heart Device Implants 2015 - 2019



#### Research

1 Research Publications

5 Oral / Poster Presentations

#### Education

##### Programme's Efforts

**September 2019** Part of in SD Transplant Centre Symposium as speakers.

Served as **Immediate past President** of International Society for Mechanical Circulatory Support (ISMCS) 2018/19.

Organised **regular heart and lung transplant journal club** for clinicians to discuss current developments in the surgical and medical field and share journal publications.

Organised educational talks for **LVAD Patient Support** presented by doctors, nurses or AHPs about topics on transplant well-being.

##### Working Alongside Industry Partners

Appointed the **Centre of Excellence for LVAD in Asia-Pacific region** by Abbott – proctoring and training for centres in Thailand and India.

One VAD Coordinator trainer appointed in VAD Coordinator programmes held in Taiwan and Australia respectively in June 2019. This serves as a channel for feedback exchange on products and latest developments.

On-going collaboration with Heart Failure team to expand education and training to include advanced heart failure. Heart failure preceptorship is organised on a regular basis for Asian regions and has taken place twice in 2019.

##### International Exposure and Experience

Invited as **speakers at the Asia Pacific Advanced Heart Failure Forum 2019**, organised by the Chinese University of Hong Kong.

**8 Transplant professionals**

Attended the following overseas conferences:  
 - 39<sup>th</sup> Annual Meeting and Scientific Sessions of ISHLT in USA  
 - HeartMate 3™ User Meeting, VAD Course in Vienna, Austria  
 - VAD Coordinator programme in Taiwan

##### Future

Collaborate with KKH to **establish a paediatric heart transplant programme** and provide training and attachments for transplant coordinators from KKH.

## Lung Transplant Programme

5-year

NHCS Patient Survival - 2010-2019

53.3%

International Benchmark

58.7%

International Benchmark

ISHLT Registry

### Clinical Services

Established in the year 2000, it is **only lung transplant programme in Singapore.**

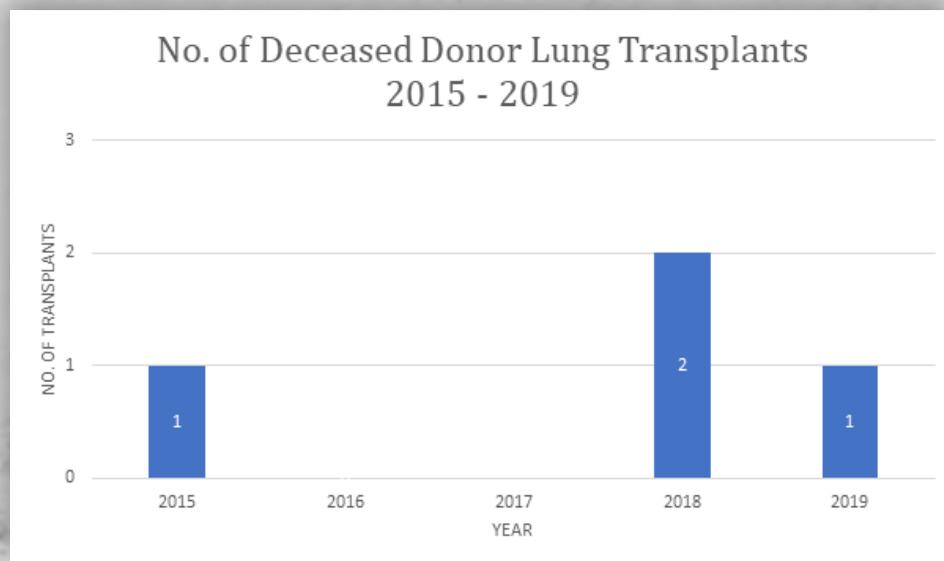
**15 Lung transplants** performed since inception.

**11 years**

Longest lung transplant recipient survival in Southeast Asia.

### Future

Develop a **Chronic Lung Disease registry** to identify more potential patients and expand the waiting list.



### Education

**29 Healthcare Professionals**

Attended the Lung Transplant Masterclass and Advanced Lung Disease and Therapies Forum 2019. Interacted with Dr. Matthew Hartwig and Dr. Laurie Snyder who are experts from Duke Transplant Centre.

Part of in **SD Transplant Centre Symposium** in September 2019 as speaker and participants.

### Future

Conduct **regular case discussions with Duke Transplant Specialists** to foster closer collaboration.

# Ovarian Tissue Transplant Programme

Clinical Quality Indicators*	Target
Risk of transferring malignant cells with transplanted frozen-thawed ovarian tissue	<0.5%
Follicle survival in fresh ovarian tissues	>91%
Follicle survival in frozen-thawed cortical tissues	>84%
Patient adverse reaction due to oophorectomy	<5%
Restoration of ovarian activity after transplantation of cryopreserved ovarian tissue at 6 months	>80%

\*Data available is currently insufficient for performance analysis as the total number of transplants performed since inception is two.

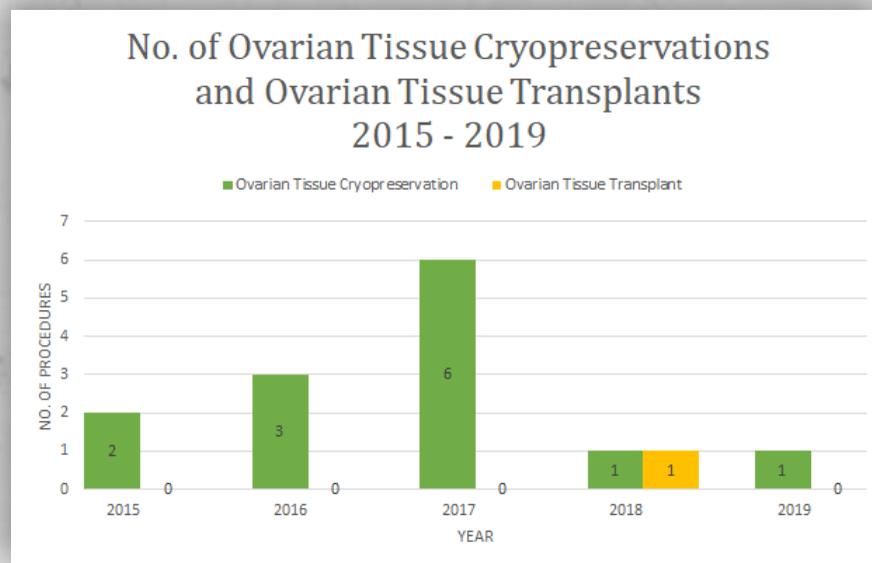
## Clinical Services

**31 Ovaries cryopreserved** since inception in 2008.

**2 Successful ovarian transplants** performed since inception, in 2012 and 2018, respectively.

## Future

Initiative to raise awareness of fertility preservation amongst oncologist through **talks delivered by specialists from the SGH Centre for Assisted Reproduction (CARE)**.



## Education

**1 clinician underwent a HMDP course on fertility preservation** at The Royal Women's Hospital, Australia.

## Future

Initiative to tap on oncologists to help highlight fertility preservation to cancer patients who may wish to start a family after recovery. This will be done by conducting public forums and talks to healthcare professionals in SGH.

# Transplant Tissue Centre

## SGH Skin Bank & NHCS Cardiovascular Homograft Bank

**5-year**

**NHCS Graft Survival - Heart valve replacement, 2008-2019**

94.7%

**International Benchmarks**

>90%<sup>1</sup>

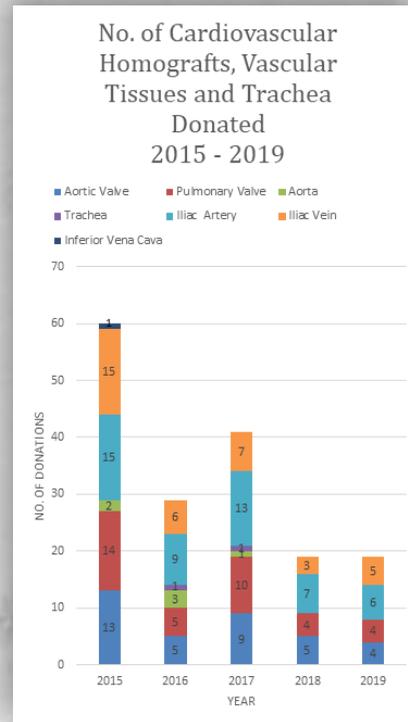
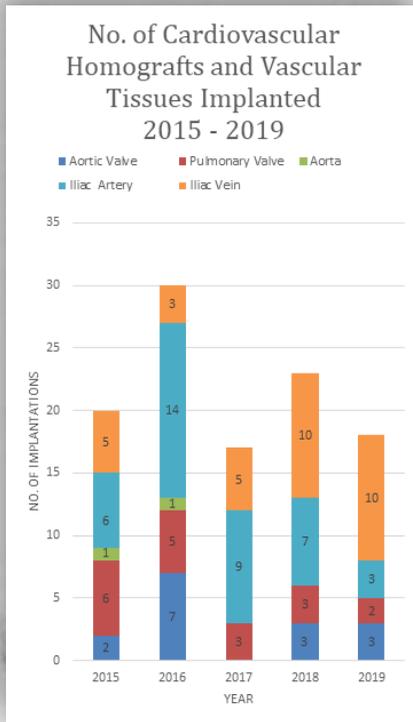
88.3%<sup>2</sup>

**International Benchmarks**

<sup>1</sup>Troost E, Meyns B, Daenen W, et al. Homograft survival after tetralogy of Fallot repair: determinants of accelerated homograft degeneration. European Journal of Cardiology. 2007. 28: 2503-2509.

<sup>2</sup>Kilian E, Oberhoffer M, Gulbins H, et al. Ten years' experience in aortic valve replacement with homograft in 389 cases. Journal of Heart Valve Diseases. 2004. 13(4). 554-559.

Zero incidence of adverse reaction reported from transplanted tissues in 2019

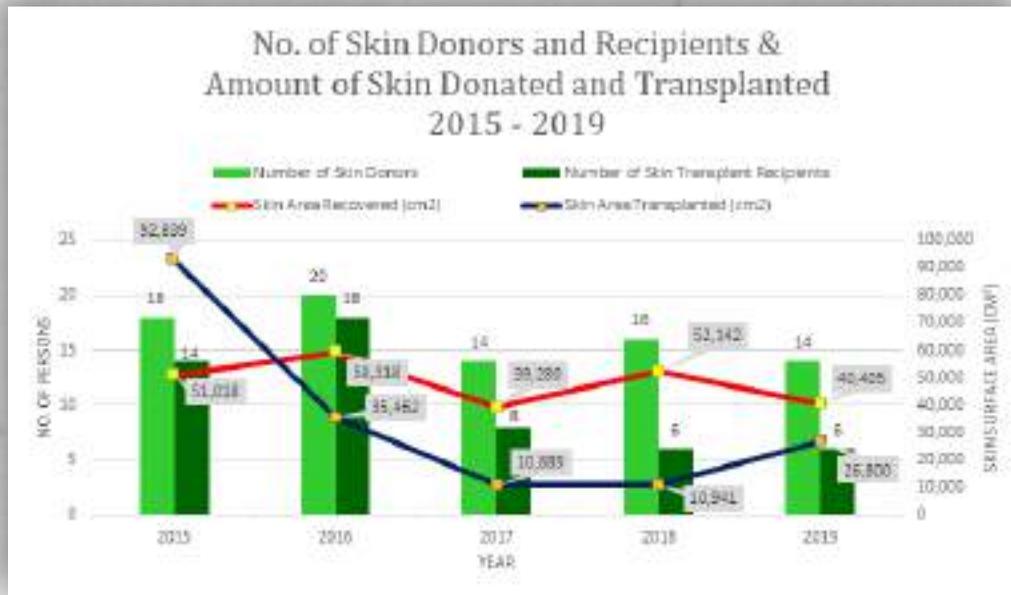


### Quality

Efforts to Improve Quality Assurance:

- **Bi-annual Clinical Quality Indicator meetings** with Tissue Advisory Committee members to discuss quality improvement and work safety issues pertaining to tissue banking.
- Improved the storage of homograft packages through the use of individual metal cassettes prior to storage.
- Conduct **environmental and personnel sterility testing** via microbiology plating during tissue processing.
- Switched to **electronic reporting of Histopathological results** to ensure completeness of all reports received and reduce lag time due to mailing of hard copy reports

**Common Skin Banking Guidelines finalised** and promulgated at the 12<sup>th</sup> APBC 2019.



**Clinical Services**

**18 Donors**

Donations obtained for skin, homograft and iliac vessels

**Future Research Plans**

Conduct **first-in-man clinical trial using laminin-based cultured epithelial autografts** to treat partial thickness to deep burns

**8 Research Publications**

**7 Oral / Poster Presentations**

**Education & Training**

**Conducted workshops to enhance technical competencies**

- Conducted cadaver workshops in skin recovery for Transplant Tissue Centre (TTC) staff and trained cardiothoracic (CTS) residents in heart recovery and other cardiac procedures.
- Conducted a heart valve dissection training workshop using pig hearts for Medical Laboratory Technologists/Scientists (MLT/MLS) and CTS surgeons for heart valve block dissection.

**500 International Delegates**

Attended the 12<sup>th</sup> APBC in which the programme played a key role organising the event.

**25 Local and International Participants**

Joined the pre-congress skin banking workshop "Skin banking: Recovery, processing, storage and distribution of human donated skin".

**Reached out to 2,800 People**

By participating in 4 roadshows and 51 small and large scale talks to raise awareness for tissue donation.

**Hosted delegates from the National Taiwan University Hospital** with discussion and knowledge exchange on skin banking, culturing. Information was also shared on our local infrastructure and our accreditation efforts.

## Corneal Transplant Programme

	1-year	5-year	10-year
<b>SNEC Graft Survival of Primary Optical Cases - 1-year and 5-year survivals, 2008-2017; 10-year survival, 2003-2017</b>	PK: 93.2% DALK: 96.8% EK: 95.8%	PK: 67.5% DALK: 95.8% EK: 83%	PK: 58.5% DALK: 95.3% EK: 76.4%
<b>International Benchmark</b>	PK: 93% DALK: 94% EK: 87%	PK: 77% DALK: 84% EK: 69%	PK: 64% DALK: 66% EK: 41%

PK - Penetrating Keratoplasty

DALK - Deep Anterior Lamellar Keratoplasty

EK - Endothelial Keratoplasty

### International Benchmark

Australian Cornea Graft Registry - 2018 report

### Quality

**Maintain and improve quality assurance** of SNEC's corneal banking and transplantation processes through:

- Ongoing audit of graft successes in SNEC at 1 year, and graft survival rates at 5 years and 10 years
- Mortality and Morbidity rounds during corneal department meetings
- Regular infection control and internal quality assurance audits
- Close surveillance of SEB's tissue contamination rates
- Monthly environmental monitoring of SEB's tissue processing facility

SEB **passed an audit** conducted by the MOH Licensing and Accreditation Unit.

### Clinical Services

#### 291 corneal transplants performed in SNEC.

This makes up 61% of the total number of corneal transplants performed in Singapore (480).

#### 45% Increase in the number of DMEK procedures performed

which offers better visual outcomes and graft survival.

**Innovative procedures** such as regenerative therapy for pediatric corneal grafts, Descemet Membrane Transfer (DMT), Simple Limbal Epithelial Transplant (SLET) and Biologic Inlay for Presbyopia were performed.

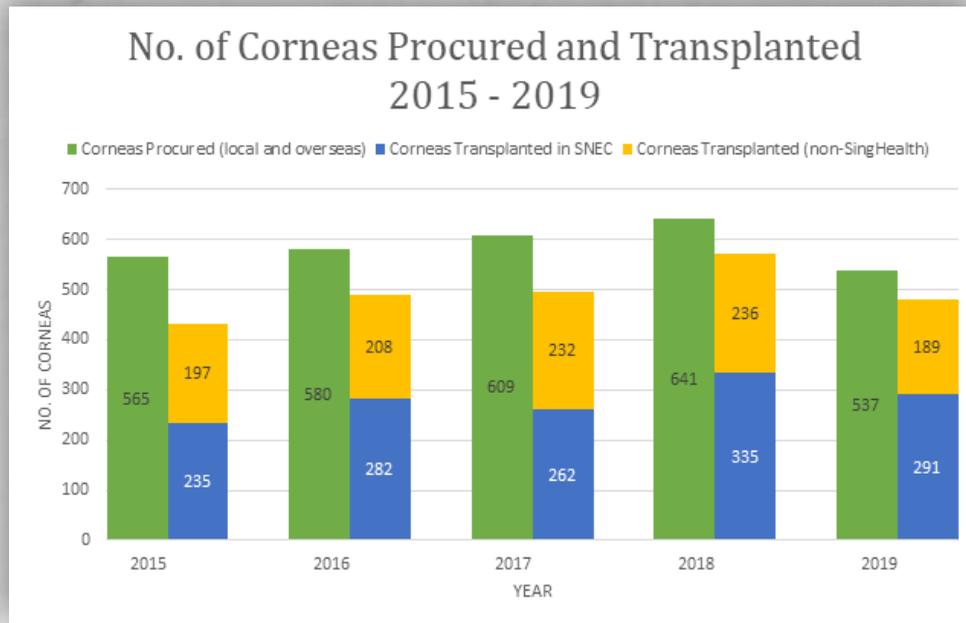
SEB commenced its pre-stripping service for donor corneas used in DMEK in April 2019 and is the **first eye bank in Asia to provide this service**.

SNEC Corneal Service implemented **mandatory post-operative bacterial and fungal corneal rim cultures** for all corneal transplant cases to arrest donor-to-host infections more effectively.

### Future

Aim to **provide orientation marking on processed DMEK corneal tissue as well as pre-loaded tissues** upon surgeons' requests. Will enhance SEB's tissue processing technique.

Plans for **collaborative organ donation drives and eye donation awareness activities** to optimise the volume of local corneal donation.



## Research

Beefed up recruitment of participants for corneal clinical studies and enhance communication on corneal research through the **commencement of Corneal Research Bulletin**. To feature information on the following studies:

- Femtosecond laser-assisted corneal/ refractive surgery – biologic inlay for presbyopia.
- Tissue Engineered Endothelial Keratoplasty clinical trial.
- SEB study comparing tissue parameters of corneas stored between two different storage media (Optisol-GS versus Life4C).
- SEB 5-year retrospective analysis of transplant rates of phakic versus pseudophakic local donors.

## Education & Training

### 8 Participants targeted

Conducted the Advanced Corneal Surgery DMEK/ Anterior Lamellar Keratoplasty (ALK)/ DSAEK course.

### 19 Participants

Conducted the 31<sup>st</sup> and 32<sup>nd</sup> SEB Cornea Procurement Accreditation Courses.

# Haematopoietic Stem Cell (Adult) Transplant Programme

	1-year	5-year	10-year
<b>SGH Patient Overall Survival (first time transplants) - 1-year and 5-year survivals, 2009-2018; 10-year survival, 2004-2018</b>	ALL: 65.3% AML: 69.9%	ALL: 52.1% AML: 54.7%	ALL: 39.9% AML: 38.3%
<b>International Benchmark</b>	ALL: 45%-80% <sup>1</sup> AML: 45%-80% <sup>1</sup>	ALL: 28%-60% <sup>1</sup> AML: 25%-60% <sup>1</sup>	ALL: Not available AML: Not available

	1-year	2-year	5-year
<b>SGH Non-relapse Mortality (first time transplants) - 2009-2018</b>	AML: 13.8%	ALL: 27.6%	ALL: 31.1% AML: 20.4%

ALL: 25% at 2 years post transplant<sup>2</sup>

## International Benchmarks

International benchmark for AML, refer to point 3 below, Figure 2a in the journal, "Similar outcomes using myeloablative vs reduced-intensity allogeneic transplant preparative regimens for AML or MDS". International benchmark for ALL, refer to point 2 below. 2-year transplant survival at 25%.

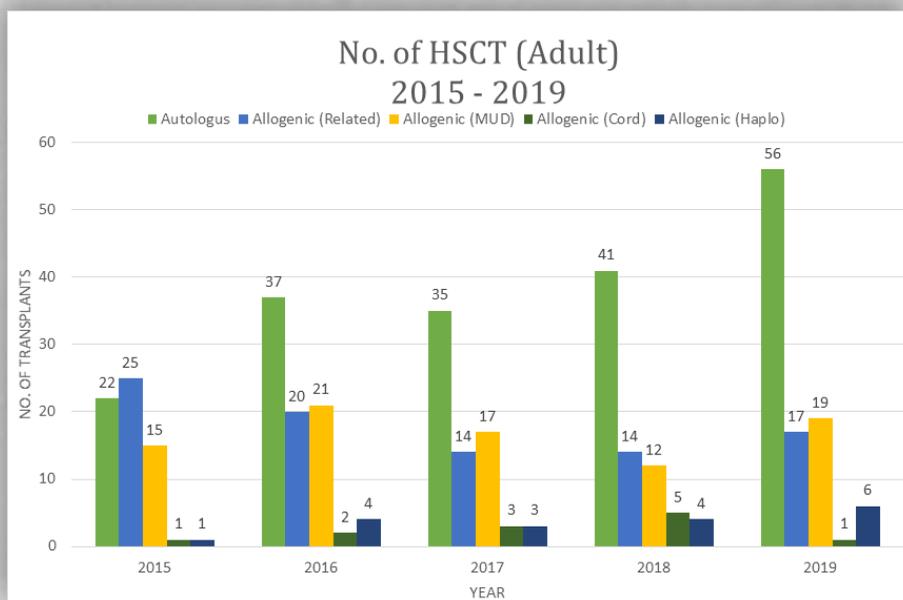
ALL - Acute Lymphoblastic Leukaemia    AML - Acute Myeloid Leukaemia

## International Benchmarks

<sup>1</sup> Center for International Blood and Marrow Transplant Research (CIBMTR) reported outcomes for 2006 to 2016

<sup>2</sup> Giebel et al 2017. Haematologica 102(1):139-149.

<sup>3</sup> Luger, S. M., et al. (2012). "Similar outcomes using myeloablative vs reduced-intensity allogeneic transplant preparative regimens for AML or MDS." Bone Marrow Transplant 47(2): 203-211.



**Quality**

Submitted **Joint Accreditation Committee – International Society for Cellular Therapy & EMBT (JACIE)** re-accreditation application

Median for overall **pre-transplant essential data submission rate increased from 14% to 65%** through efforts by the data management team. This was accomplished through **new workflows and developing training material for completing the forms.**

**Clinical Services**

**33**

**Cellular Therapies carried out.**

These include:  
peripheral blood stem cell top-up, rescue and donor leukocyte infusion and mesenchymal stem cell

**99**

**Stem cell transplants performed**

**72**

**Extracorporeal Photopheresis (ECP) procedures performed**

**178**

**Cellular therapy products collected**

**282**

**Cellular therapy products processed**

Multidisciplinary HSCT long-term follow-up clinic resulted in **improved management of late complications in 61.5%** of HSCT transplant patients.

Multidisciplinary team conducted **six pilot sessions** for HSCT patients in the patient support group. Volunteers **continued to provide support through phone calls and SMSes during the current COVID-19 climate.**

**Future**

Assess feasibility and safety of providing **home-based transplantation to eligible patients** while evaluating potential cost savings and survival outcome indicators.

**Research**

**5 Research Publications**

**2 Oral / Poster Presentations**

**Education**

**1 Clinician**

completed HMDP Clinical Fellowship for cell therapy at MD Anderson Cancer Centre.

## Haematopoietic Stem Cell (Paediatric) Transplant Programme

	1-year	5-year	10-year
<b>KKH Patient Overall Survival (first time allogeneic transplants for high risk leukaemia) - 1-year and 5-year survivals, 2009-2018; 10-year survival, 2004-2018</b>	86.5%	68.4%	62.2%
<b>International Benchmark</b>	ALL: 75% <sup>1</sup> AML: 85% <sup>1</sup>	ALL: 64% <sup>1</sup> AML: 68% <sup>1</sup>	Not available
<b>KKH Non-relapse Mortality (first time allogeneic transplants for high risk leukaemia) - 1-year and 5-year survivals, 2009-2018; 10-year survival, 2004-2018</b>	3.8%	16.2%	20.8%
<b>International Benchmark</b>	10%-20% at 100 days post transplant <sup>2</sup>		

ALL - Acute Lymphoblastic Leukaemia    AML - Acute Myeloid Leukaemia

### International Benchmarks

<sup>1</sup> Center for International Blood and Marrow Transplant Research (CIBMTR) reported outcomes for 2016

<sup>2</sup> CIBMTR reported outcomes for 2010 to 2011

### Quality

Maintain quality standards of transplant programme through:

- Continuous review and discussion of clinical quality indicators
- Review of all incidences and all near-misses
- Weekly transplant grand rounds

### Future

Progress towards **Foundation for the Accreditation of Cellular Therapy (FACT) accreditation in 2021.**

### Clinical Services

Continued refinement of **haploidentical stem cell transplantation** has helped build expertise in performing alternative donor transplants. It has also **increased the accessibility to transplants and produced excellent outcomes.**

#### 100% Survival

Achieved for haploidentical stem cell transplantation performed for Thalassemia and Primary Immunodeficiency Disorder (PID) patients.

Three transplants performed for Thalassemia were **100% free from GVHD and transfusion.**

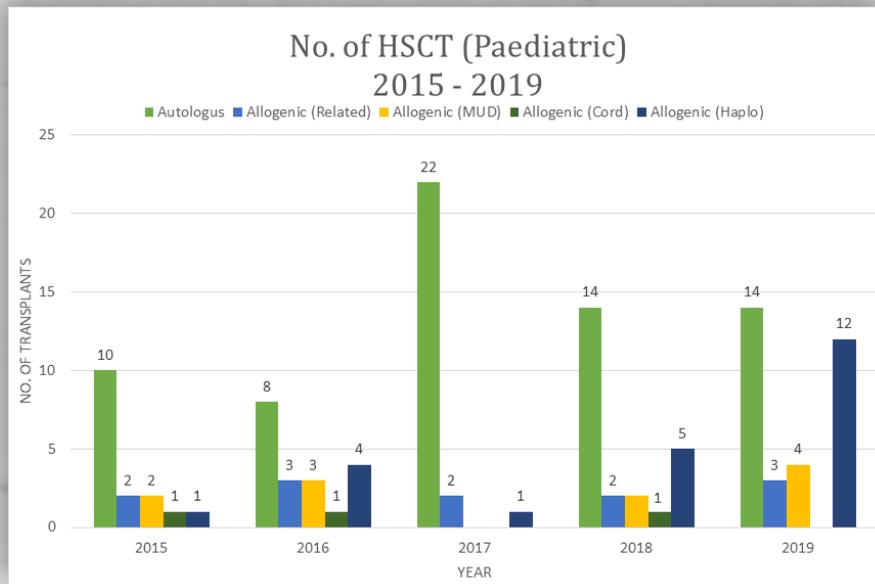
Five transplants were performed for PID with both Severe Combined Immunodeficiency (SCID) and non-SCID indications.

#### 15 Transplant Survivors

Benefited from being included in Paediatric Oncology Survivorship programme since its inception in 2017.

### Future

To **develop in-house capacity** for cellular therapy processing and minimal residual disease (MRD) analysis.



## Research

**Establishment of KKH BMT and Cell Therapy Centre in Academia** with multiple basic and translational research projects in the pipeline, including laboratory support for the Chimeric Antigen Receptor (CAR) T-Cell Programme.

Update of **Haplo 17 Protocol results have been presented as an oral presentation** at EBMT 2019 and American Society of Hematology (ASH) 2019.

### 1 Clinician

Funded by National Medical Research Council (NMRC) Research Training Grant to work on immune-effector cell therapies.

**4 Research Publications**

**4 Oral / Poster Presentations**

## Future

**CAR-T clinical trials**, including novel dual CAR-T clinical trials, are in the pipeline for 2020.

## Education

### 4 Staff

Funded by LFG to attend EBMT training in Spain.

### Continued Development

Faculty teaching through transplant professional rounds and teaching sessions, In house training for HSCT nurses and weekly transplant grand rounds.

## People

Ms Queenie Gan came onboard as **Quality Manager** to support the quality management of haematopoietic stem cell transplant programme.

## Singapore Cord Blood Bank

### Performance for Clinical Quality Indicators, 2019:

Clinical Quality Indicators	Performance	Target
Percentage of patients getting engrafted	100%	>85%
Average days of neutrophil engraftment (ANC 500)	27 days	<28 days
Average days of platelet engraftment (Platelet 20,000)	52 days	<60 days

### Quality

Launched DocuSign to enable digital consent-taking to be carried out remotely. This improvement in the consent-taking process has **led to a 30% increase in maternal donors** in the last quarter 2019.

### Clinical Services

#### 4 Local Beneficiaries

Facilitated:

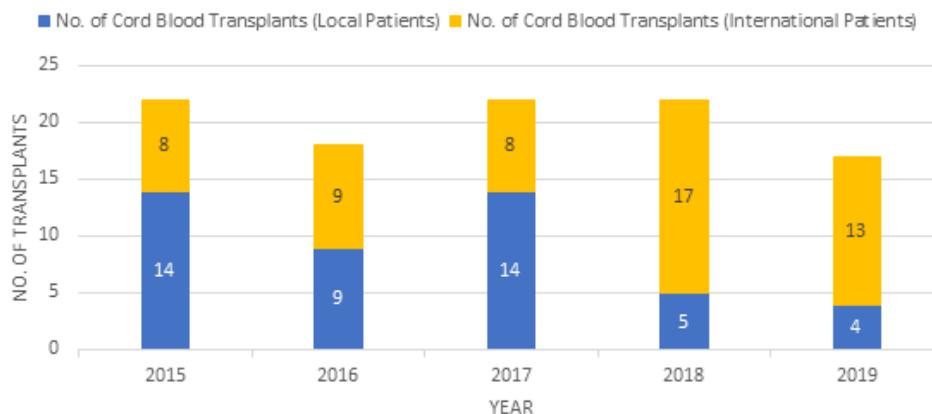
- Adult Unrelated Allogeneic Transplantation (3)
- Autologous Transfusion for Autism (1)

#### 13 International Beneficiaries

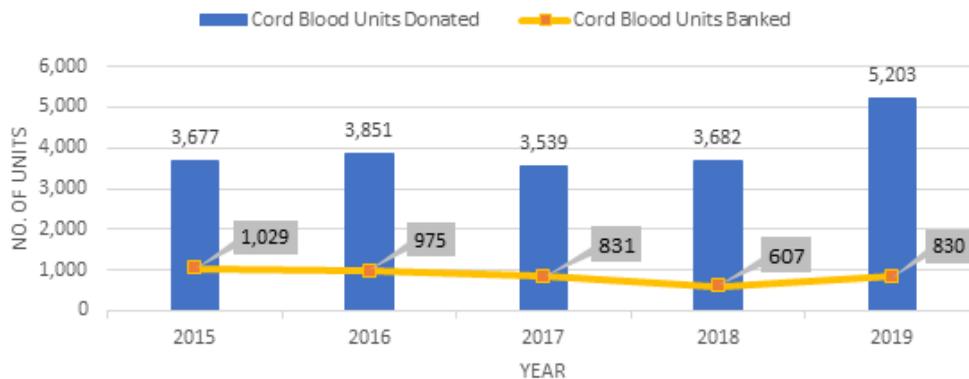
Facilitated adult transplantation for:

- Acute Lymphoblastic Leukaemia (4)
- Acute Myelogenous Leukaemia (6)
  - Aplastic Anaemia (1)
- Myelodysplastic Syndrome (2)

### No. of Cord Blood Transplants 2015 - 2019



### No. of Cord Blood Units Donated & Cord Blood Units Banked 2015 - 2019



#### Research

##### 55 Cord Blood Units

Provided for the following research projects:

- Pre-clinical development of expanded umbilical cord blood grafts using Imidazole derivatives for bone marrow transplantation
- Targeting telomere maintenance for therapeutic intervention in human cancer and ageing
- Cellular reprogramming of human cord blood
- Appreciation of a novel immunosuppressive two-factor cocktail in human immunological disorders

#### Future

Collaborate with the SNEC to **provide cord blood plasma as eye drops** for specific clinical conditions.

Engage clinicians and researchers to **explore the application of cord blood platelets in wound healing** - focusing on diabetic patients.

Explore the feasibility to **provide cord tissue banking under the Human Tissue Framework of Human Biomedical Research Act** to support the growing number of clinical trials on application of umbilical cord tissue.

#### Education & Engagement

##### Leveraged on social media and events to raise public awareness

Conducted the following public awareness and outreach activities:

- Made its foray into Baby Fair
- Continued to support KKH's Antenatal Programme and participated in four antenatal talks.
- Connected and engaged with the public through social media marketing on Facebook and Instagram
- Partnered with local Malay influencers to expand outreach to the Malay community
- Featured donor and patient's stories on print media
- Celebrated World Cord Blood Day with 500 donors and their families, cord blood recipients, volunteers and corporate supporters

# Transplant in the News

## New organ transplant centre to offer better care, shorter wait



Health Minister Gan Ean Yong announced the launch of the SingHealth Duke-NUS Transplant Centre on April 12 during the 23rd SGA annual scientific meeting. PHOTO: SGA

© PUBLISHED APR 13 2019 5:00 AM SGT

THE STRAITS TIMES

SingHealth Duke-NUS research, education hub to explore ways to boost and

Fuel Wazamba

## Long-Term Management of Liver Transplant Recipients: The Primary Care Perspective

This article is contributed by Dr. Ganesh Kumar from Singapore General Hospital



Liver Transplantation (LT) outcomes have improved dramatically over the decades. The 1-year and 5-year survival after LT is around 80% and 70% respectively. With increasing numbers of long-term survivors, Primary Care Physicians (PCPs) are seeing larger numbers of solid organ recipients in their practice.

## 与家属沟通捐出死者细胞组织 协助延续生命是她的使命

与家属沟通捐出死者细胞组织 协助延续生命是她的使命



与家属沟通捐出死者细胞组织 协助延续生命是她的使命

## Generation Grit: Beneath that smile beats a heart of courage



At the age of 22, Mr Kevin Wong had the heart of an old man that only a transplant could run. He tells The Straits Times what kept him going, when years passed and no donor heart was in sight, in this series about millennials who inspire us.

© PUBLISHED FEB 26 2018 5:00 AM SGT

THE STRAITS TIMES

At the age of 22, Mr Kevin Wong had the heart of an old man that only a transplant could run. He tells The Straits Times what kept him going, when years passed and no donor heart was in sight, in this series about millennials who inspire us.

Thomas Tan Senior Social Media Correspondent

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# An Update on Liver Transplant – ABO Incompatible Grafts

Professor Chung Yaw Fui Alexander, Senior Consultant,  
Department of Hepato-pancreato-biliary and Transplant Surgery, Singapore General Hospital

### THE INDICATIONS/NEED

Liver transplant is the treatment of choice for end-stage liver disease (liver cirrhosis, advanced liver failure and non-metastatic, low tumour burden Hepatocellular Carcinoma (HCC) in Singapore, while Hepatitis B infection is on the decline with compulsory vaccination at birth, an emerging cause of chronic liver disease is steatohepatitis/liver. Chronic liver disease in the form of cirrhosis is the catalyst for the formation of HCC (Refer to figure 1).



Figure 1 Total hepatectomy specimen showing macro-nodular cirrhosis with HCC in the left lobe

# Current Treatment Options for Hepatocellular Carcinoma and The Role of Liver Transplantation

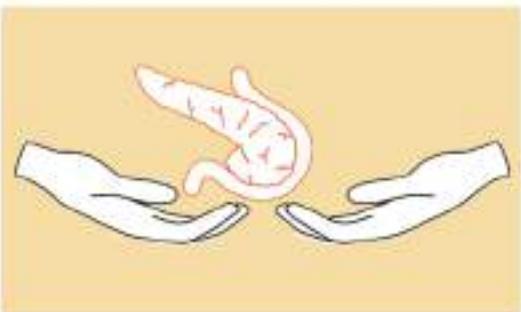
1 Mar 2019 | SingHealth Medical News  
The article is contributed/written by Singapore General Hospital, SingHealth Duke-NUS Liver Transplant Centre



from his son, infliximab, a specific immunosuppressive drug to deplete the B cells in Mr. Chen's plasma as well as wear on their function a protease antibody, was administered 3 weeks prior to transplant.

# Pancreas Transplant Programme at Singapore General Hospital

1 Mar 2019 | SingHealth Medical News  
The article is contributed/written by Singapore General Hospital



### PANCREAS TRANSPLANT IN SINGAPORE

The pancreas transplant programme at Singapore General Hospital (SGH) was started back in November 2012 as a collaborative effort with National University Hospital (NUH) to establish a national pancreas transplant programme. This was made possible with funding from the Ministry of Health (MOH) under the Health Services Development Programme (HSDP).

**NEWS** | SINGAPORE/MARCH 1, 2019 FEB 2019

## A+ can give to B+

SGH performs Southeast Asia's first blood-group-incompatible living donor liver transplant. *By Denise Lim*

**A** 50-year-old Singaporean man with end-stage liver disease and type 2 diabetes was given a living donor liver transplant from his son, a 45-year-old B+ blood group man, in the first of its kind in Southeast Asia. The transplant was performed at Singapore General Hospital (SGH) on February 28, 2019.

The patient, Mr. Chen, had been on dialysis for his kidney disease and had a long history of liver disease. His son, Mr. Chen, had been on dialysis for his kidney disease and had a long history of liver disease.

The transplant was performed by a team of experts led by Professor Chung Yaw Fui Alexander, Senior Consultant, Department of Hepato-pancreato-biliary and Transplant Surgery, SGH.

The patient is recovering well and is expected to be discharged from hospital in a few days.

**THE SKIN FROM THE OPERATOR WAS NOT AS PLUCKY AS NOT GIVING. DAD A SECOND CHANCE. THE PHYSICAL PAIN CAN BE MANAGED.**

The patient's son, Mr. Chen, said that he was very nervous before the surgery but he felt that it was worth it to help his father. He said that he was very happy to be able to help his father and that he was very proud of his father.

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# Executive Committee



**A/Prof Prema Raj**  
Head  
SingHealth-Duke NUS Transplant Centre



**A/Prof Aloysius Ho**  
Director  
Cell Transplant  
SingHealth Duke-NUS Transplant Centre



**A/Prof Tan Bien Keem**  
Director  
Tissue Transplant  
SingHealth Duke-NUS Transplant Centre



**Prof Brian Goh**  
Director  
Solid Organ Transplant  
SingHealth Duke-NUS Transplant Centre



**Prof Jodhbir Singh Mehta**  
Director  
Education  
SingHealth Duke-NUS Transplant Centre



**Prof Leung Wing Hang**  
Director  
Research  
SingHealth Duke-NUS Transplant Centre

# Programme Directors



**Dr Chakaramakkil Mathew Jose**  
Programme Director  
Cardiovascular Homograft  
Transplant



**Prof Jodhbir Singh Mehta**  
Programme Director  
Corneal Transplant



**A/Prof Aloysius Ho**  
Programme Director  
Haematopoietic Stem Cell  
(Adult) & Umbilical Cord  
Blood Transplant



**A/Prof Tan Ah Moy**  
Programme Director  
Haematopoietic Stem Cell  
(Paediatric)



**A/Prof Yu Su Ling**  
Programme Director  
Ovarian Tissue Transplant



**A/Prof Tan Bien Keem**  
Programme Director  
Skin Transplant

# Programme Directors



**Dr Tan Teing Ee**  
Programme Director  
Heart Transplant



**A/Prof Prema Raj**  
Programme Director  
Liver Transplant



**Dr Ong Boon Hean**  
Surgical Director  
Lung Transplant



**Dr Phua Ghee Chee**  
Medical Director  
Lung Transplant



**Dr Valerie Gan**  
Programme Director  
Pancreas - Kidney Transplant



**Dr Kanagasabapathy  
Kamaraj**  
Medical Director  
Pancreas - Kidney Transplant



**A/Prof Terence Kee**  
Programme Director  
Renal Transplant

# Specialty Leads



**Ms Low Wai Yan**  
Lead  
Allied Health Professionals



**Ms Cherry Li**  
Co-Lead  
Allied Health Professionals



**A/Prof Tan Ban Hock**  
Lead  
Infectious Diseases



**A/Prof Aloysius Ho**  
Lead  
Clinical Quality Improvement



**Ms Chong Lai Ling**  
Lead  
Nursing



**Dr Crystal Lim**  
Lead  
Transplantation Ethics



**Dr Thinesh Lee**  
Clinical Director  
Transplant Clinic

# Advisors



**A/Prof Ng Heng Joo**  
Advisor  
Senior Consultant (Head)  
Haematology



**Dr Soh Shui Yen**  
Advisor  
Senior Consultant (Head)  
Paed Subspec, Haematology/  
Oncology Service



**A/Prof Ong Yee Siang**  
Advisor  
Senior Consultant (Head)  
Plastic, Reconstructive &  
Aesthetic Surgery



**Mrs Tan-Huang Shuo Mei**  
Advisor  
Chief Executive Officer  
Singapore Cord Blood Bank



**A/Prof Jason Chang**  
Advisor  
Senior Consultant (Head)  
Gastroenterology &  
Hepatology



**A/Prof Chan Chung Yip**  
Advisor  
Senior Consultant (Head)  
Hepato-pancreato-biliary &  
Transplant Surgery



**A/Prof Tan Teng Hong**  
Advisor  
Senior Consultant (Head)  
Paed Subspec, Cardiology  
Service



**A/Prof Yong Tze Tein**  
Advisor  
Senior Consultant (Head)  
Obstetrics & Gynaecology



**Dr Marjorie Foo**  
Advisor  
Senior Consultant (Head)  
Renal Medicine



**A/Prof Henry Ho**  
Advisor  
Senior Consultant (Head)  
Urology



**A/Prof Ng Shin Yi**  
Advisor  
Head, SICU (SGH)

## National Transplant Appointments



**A/Prof Tan Chee Kiat**  
Director  
National Organ Transplant Unit  
Ministry of Health



**A/Prof Terence Kee**  
President  
Society of Transplantation  
(Singapore)



**Dr Thinesh Lee**  
Chairman  
Subcommittee for  
Liver Transplantation  
Ministry of Health

## A SD Transplant Centre Retreat Vision In Action

How does a Transplant Centre of 12 unique programmes located in different places across SingHealth grow together?

This was the pivotal motivation for the SD Transplant Centre Retreats; to deliberate on strategies and plans for the growth of the transplant programmes in SingHealth. A two-pronged approach was deployed to engage the stakeholders as well as professionals on the ground – this comprised a leadership retreat at Academia on SGH Campus as well as a community engagement retreat at Changi Cove.

The leadership retreat saw the alignment of the various transplant programmes to a newly-formed shared aspirational identity of a Transplant Centre.

Unified by a common purpose to improve human life through advancements in the field of transplantation, the leadership retreat mobilised the different transplant programmes to reimagine a future with the formation of the SD Transplant Centre. The programme directors recognised the value of **the Centre as a catalyst to reach strategic goals in research, education and advocacy**. As a collective entity, the programmes could leverage the resources and talent available through sharing and collaboration. The Head of the SD Transplant Centre, A/Prof Prema Raj, was inspired by famous American football coach Vince Lombardi and coined the central principle of “Pursuing perfection, catching excellence”. The future envisioned was one realised through deliberate and concrete steps to make the Centre the central point to coordinate these efforts. In order to enable a more impactful advancement in transplantation in Singapore and the region, concerted efforts in transplant education, research and outreach need to be invested from the expertise within the transplant centre.



At the engagement retreat, A/Prof Prema Raj shared that the transplant service in SingHealth is delivered not only by clinicians. A significant portion of a patient's transplant journey is spent with transplant Allied Health Professionals and nurses. Following his introductory speech, participants from the different programmes played a game called 'Dream Team' where each team formed a perfect "transplant team" from a list of superheroes. From the activity, we learned that a Dream Team is formed when teams affirmed the unique strengths of each individual and cooperated to build each other up.

Teams also participated in various activities including "Traffic Jam" which had an element of creative problem solving. In "Vision in Action", participants took part in a brainstorming activity and penned their ideas and thoughts on post-it notes under the categories of "Education", "Advocacy", "Research", "Clinical Services" and "Development." A/Prof Prema Raj was invited to select some of his favourite submissions from the participants for discussion. These include:

- To boost interaction among different transplant programmes and services in SingHealth
- To support visits to overseas transplant centres to observe and learn how others manage transplant patients to enhance our knowledge
- To gather different teams to work in an environment of collaboration and sharing
- To be open-minded to change and welcome cross-training

From the conversations and discussions that were sparked at the retreat, the SD Transplant Centre Retreat 2019 was successful in creating pockets of shared memories through interactions among the transplant professionals. Many of our participants shared positive feedback on how the retreat has enabled them to take time off their busy schedules to spend time with fellow colleagues involved in transplant to familiarise with each other's profession and interests.

\*This event was supported by LFG.



“I am very grateful to the donor family for giving me a second chance in life. I will treasure it by living a healthy lifestyle.”

Mr Mohamed Rezal Yusof, heart transplant recipient



ST PHOTO: SYAMIL SAPARI

"I ask patients whom I meet to always be positive, believe in the treatment and focus all their energy on recovery. This beautiful gift of life is so worth living."

Ms Viji Ramakrishnan, Haematopoietic Stem Cell Transplant Recipient and patient support group volunteer



ST PHOTO: ONG WEE JIN

“The pain from the operation was not as much as not giving dad a second chance. The physical pain can be overcome.”

Mr Chen Qingzhong, son and living liver donor to his father

**Click here to visit the SD Transplant Centre website:**



**List of Scientific Research Publications**

**Transplant Commemorative Book  
(Coming soon in Oct 2020)**

# Research in Transplantation

Top 5 research articles displayed. Visit the SD Transplant Centre via QR code to view the full list.

TITLE OF ARTICLE		AUTHOR(S)	PUBLICATION DETAILS
<b>SKIN TRANSPLANT</b>			
1	A sintered graphene/titania material as a synthetic keratoprosthesis skirt for end-stage corneal disorders	Li Z*, Goh TW*, Yam GH, Thompson BC, Hu H, Setiawan M, Sun W, Riau AK, Tan DT, Khor KA, Mehta JS.	Acta Biomater. 2019 Aug;94:585- 596. doi:10.1016/j.actbio.2019.05.053. Epub 2019 May 24.
2	Characterization of Human Transition Zone Reveals a Putative Progenitor-Enriched Niche of Corneal Endothelium	Yam GH, Seah X, Yusoff NZBM, Setiawan M, Wahlig S, Htoon HM, Peh GSL,, Kocaba V, Mehta JS	Cells. 2019 Oct 12;8(10). pii: E1244. doi: 10.3390/cells8101244.
3	Descemet Membrane Endothelial Keratoplasty Versus Descemet Stripping Automated Endothelial Keratoplasty and Penetrating Keratoplasty	Woo JH, Ang M, Htoon HM, Tan D.	Am J Ophthalmol. 2019 Nov;207:288-303. doi: 10.1016/j.ajo.2019.06.012. Epub 2019 Jun 19.
4	Functional Evaluation of Two Corneal Endothelial Cell-Based Therapies: Tissue-Engineered Construct and Cell Injection	Peh GSL*, Ong HS*, Adnan K, Ang HP, Lwin CN, Seah XY, Lin SJ, Mehta JS.	Sci Rep. 2019 Apr 15;9(1):6087. doi: 10.1038/s41598-019-42493-3.
5	Infectious corneal ulceration: a proposal for neglected tropical disease status	Ung L, Acharya NR, Agarwal T, Alfonso EC, Bagga B, Bispo PJ, Burton MJ, Dart JK, Doan T, Fleiszig SM, Garg P, Gilmore MS, Gritz DC, Hazlett LD, Iovieno A, Jhanji V, Kempen JH, Lee CS, Lietman TM, Margolis TP, McLeod SD, Mehta JS, Miller D, Pearlman E, Prajna L, Prajna NV, Seitzman GD2, Shanbhag SS5, Sharma N, Sharma S, Srinivasan M, Stapleton F, Tan DT, Tandon R, Taylor HR, Tu EY, Tuli SS, Vajpayee RB, Van Gelder RN, Watson SL, Zegans ME, Chodosh J.	Bull World Health Organ. 2019 Dec 1;97(12):854-856. doi: 10.2471/BLT.19.232660. Epub 2019 Nov 1.

TITLE OF ARTICLE		AUTHOR(S)	PUBLICATION DETAILS
<b>HAEMATOPOIETIC STEM CELL (ADULT) TRANSPLANT</b>			
1	Advances in hematopoietic stem cell transplantation in the Asia-Pacific region: the second report from APBMT 2005-2015.	Iida M, Kodera Y, Dodds A, Ho AYL, Nivison-Smith I, Akter MR, Wu T, Lie AKW, Ghavamzadeh A, Kang HJ, Ong TC, Gyi AA, Farzana T, Baylon H, Gooneratne L, Tang JL,	Bone Marrow Transplant. 2019 May 14. doi:10.1038/s41409-019-0554-9. [Epub ahead of print]
2	A novel simplified method of generating cytomegalovirus-specific cytokine-induced killer cells of high specificity and superior potency with GMP compliance.	Clin Immunol. 2019 Jun 21;205:83-92. doi: 10.1016/j.clim.2019.06.007. [Epub ahead of print]	Luah YH, Sundar Raj K, Koh MBC, Linn YC.
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4	Haploidentical transplantation and post-transplant cyclophosphamide for treating aplastic anemia patients: a report from the EBMT Severe Aplastic Anemia Working Party.	Pedro Prata, Diderik-Jan Eikema, Boris Afanasyev, Paul Bosman, Frans Smiers, Jose Luis Díez-Martín, Celso Rodrigues, Yener Koc, Xavier Poiré, Anne Sirvent, Nicolaus Kröger, Fulvio	Bone Marrow Transplant. 2019 Dec 16. doi: 10.1038/s41409-019-0773-0. [Epub ahead of print] PubMed PMID: 31844137.
5	Phase I/II Study of Stem-Cell Transplantation Using a Single Cord Blood Unit Expanded Ex Vivo With Nicotinamide	Horwitz ME, Wease S, Blackwell B, Valcarcel D, Frassoni F, Boelens JJ, Nierkens S, Jagasia M, Wagner JE, Kuball J, Koh LP, Majhail NS, Stiff PJ, Hanna R, Hwang WYK, Kurtzberg J, Cilloni D, Freedman LS, Montesinos P, Sanz G.	J Clin Oncol. 2019 Feb 10;37(5):367-374. doi: 10.1200/JCO.18.00053. Epub 2018 Dec 4.

TITLE OF ARTICLE		AUTHOR(S)	PUBLICATION DETAILS
<b>HAEMATOPOIETIC STEM CELL (PAEDIATRIC) TRANSPLANT PROGRAMME</b>			
1	Childhood chronic myeloid leukemia in Singapore: Is there a role for hematopoietic stem cell transplantation in the TKI era?	Ah Moy Tan, Mya Soe Nwe, Vijayakumari K, Mei Yoke Chan, Vinod Gunasekaran, Prasad Iyer & Poh Lin Tan	Bone Marrow Transplantation (2019) 54:144–619. P094 Page 204.
2	Haploidentical HSCT in malignant & non-malignant disorders in a single paediatric center-A SE Asia perspective	Ah Moy Tan, Michaela Seng, K Vijaya, Shui Yeh Soh, Leung Wing	Blood Research vol 54 Suppl2 August 2019 PE 121 -473.
3	HLA-Haploidentical Hematopoietic Cell Transplantation after TCR- $\alpha\beta$ and CD45RA+ Depletion Following Reduced Intensity Conditioning in Adults and Children with Hematological Malignancies- Two-year follow-up of Multicenter	Michelle Poon , Yeh Ching Linn, Wing Leung, Poh Lin Tan, Zi Yi Lim, Colin Diong, B Vellayappan ,Rajat Bhattacharyya, Ah Moy Tan, Lip Kun Tan, Teck Guan Soh, Liang-Piu Koh	Blood 2019; 134 (Supplement_1): 2039. doi: <a href="https://doi.org/10.1182/blood-2019-128014">https://doi.org/10.1182/blood-2019-128014</a> .
4	HSCT in children with bone marrow failure: Outcomes from a single Singapore center	Prasad Iyer, M Seng ,Ah Moy Tan , K Vijaya , MY Chan R Bhattacharyya	Bone Marrow Transplantation (2019) 54:144–619. P644 Page 553.
<b>SKIN TRANSPLANT</b>			
1	Isolation and culture of hair follicle dermal sheath mesenchymal stromal cells.	Ma D, Lee ST, Chua AWC	(2019) In: Bottcher-Haberzeth S., Biedermann T. (eds) Skin Tissue Engineering, Methods in Molecular Biology, vol 1993. Humana, New York, NY.
2	Skin tissue engineering in severe burns: A review on its therapeutic applications	Chua AWC, Saphira CF, Chong SJ	(2019) In: Duscher D, Shiffman M (eds) Regenerative Medicine and Plastic Surgery. Springer, Cham

TITLE OF ARTICLE		AUTHOR(S)	PUBLICATION DETAILS
<b><u>HEART TRANSPLANT PROGRAMME</u></b>			
1	Staphylococcal Driveline Infections are the Predominant Type of Left Ventricular Assist Device Associated Infections in Singapore	Yii Ean Teh, Choon Pin Lim, Louis Loon Yee Teo, Jia Lin Soon, Victor Tar Toong Chao, Chia Lee Neo, Joycelyn Lili Tan, Ka Lee Kerk, David Kheng Leng Sim, Teing Ee Tan, Ban Hock Tan, Sivathasan Cumaraswamy, Thuan Tong Tan	Infectious Diseases (Society), Feb 2019 <a href="https://doi.org/10.1080/23744235.2019.1592216">https://doi.org/10.1080/23744235.2019.1592216</a>
<b><u>LIVER TRANSPLANT PROGRAMME</u></b>			
1	Outcome of salvage liver transplant for recurrent HCC: a comparison with primary liver transplant.	Yuxin Guo,1 Ek-Khoon Tan,1 Thinesh-Lee Krishnamoorthy,2 Chee-Kiat Tan,2 Ban-Hock Tan,3 Thuan-Tong Tan,3 Ser-Yee Lee,1 Chung-Yip Chan,1 Peng-Chung Cheow,1 Alexander Y. F. Chung,1 Prema Raj Jeyaraj,1 and Brian K. P. Goh 1,4	Ann Hepatobiliary Pancreat Surg 2019 Feb; 23(1): 1–7.
2	Repeat liver resection versus salvage liver transplant for recurrent hepatocellular carcinoma: a propensity score-adjusted and -matched comparison analysis. Ann Hepatobiliary Pancreat Surg 2019.	Yuxin Guo1, Ek-Khoon Tan1, Nicholas L. Syn1, Thinesh-Lee Krishnamoorthy2, Chee-Kiat Tan2, Reina Lim2, Ser-Yee Lee1, Chung-Yip Chan1, Peng-Chung Cheow1, Alexander Y. F. Chung1, Prema Raj Jeyaraj1, Brian K. P. Goh1,3.	Ann Hepatobiliary Pancreat Surg 2019.
3	Safety and Benefit of Using Liver Grafts From Older Donors.	Goh BKP	2019 JAMA Surg. 2019 Jul 24. doi:10.1001/jamasurg.2019.2183
4	Tacrolimus Monotherapy in Recipients of Liver Transplant: A Single-Center Experience.	Lin SL, Krishnamoorthy TL, Kumar R, Lim TR.	Transplantation Proceedings 2019 Jul-Aug;51(6):1920-1922. PMID:31399176
5	Use of Expression Profiles of HBV DNA Integrated Into Genomes of Hepatocellular Carcinoma Cells to Select T Cells for Immunotherapy. Gastroenterology 2019;156:1862-1876	*Tan AT, *Yang N, *Krishnamoorthy TL, Oei V, Chua A, Xinyuan Z, Si TH, Chia A, Le Bert N, Low D, Tan HK, Kumar R, Irani FG, Zong HZ, Zhang Q, Guccione E, Lu-En W, Koh S, Hwang W, Chow WC, Bertolotti A. (*contributed equally to this work).	Gastroenterology 2019;156:1862-1876

TITLE OF ARTICLE		AUTHOR(S)	PUBLICATION DETAILS
<b><u>PANCREAS-KIDNEY TRANSPLANT PROGRAMME</u></b>			
1	Islet macrophages are associated with islet vascular remodeling and compensatory hyperinsulinemia during diabetes	M Chittezhath et al	Am J Physiol Endocrinol Metab. 2019
2	Human Islet Isolation and Distribution Efforts for Clinical and Basic Research	Ng NHJ, Tan WX, Koh YX, Teo AKK.	OBM Transplantation 2019;3(2):31;doi:10.21926/obm.transplant.1902068
<b><u>RENAL TRANSPLANT PROGRAMME</u></b>			
1	Characterization of Human Transition Zone Reveals a Putative Progenitor-Enriched Niche of Corneal Endothelium	Yam GH, Seah X, Yusoff NZBM, Setiawan M, Wahlig S, Htoon HM, Peh GSL, Kocaba V, Mehta JS	Cells. 2019 Oct 12;8(10). pii: E1244. doi: 10.3390/cells8101244.
2	Desmopressin for the prevention of bleeding in percutaneous kidney biopsy: efficacy and hyponatraemia.	Lim CC, Siow B, Choo JC, Chawla M, Chin YM, Kee T, Lee PH, Foo M, Tan CS.	Int Uro Nephrol 2019; 51(6): 995-1004. doi: 10.1007/s11255-019-02155-9.
3	Incidence, risk factors and outcomes of malignancies after kidney transplantation - a 12 year experience.	Teo SH, Lee KG, Lim HG, Koo SX, Ramirez ME, Chow KY, Kee T.	Singapore Med J 2019; 60: 253-259.
4	The use of intravesical cidofovir for the treatment of adenovirus associated hemorrhagic cystitis in a kidney transplant recipient.	Ho QY, Tan CS, Thien SY, Kee T, Chlebicki MP.	Clin Kidney J 2019; 12: 745-747.





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