



KK Women's and  
Children's Hospital  
SingHealth



## YEARS OF PAEDIATRIC SURGERY IN SINGAPORE (1981 – 2021)



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Honouring the Past, Embracing the Future



# **40 YEARS OF PAEDIATRIC SURGERY IN SINGAPORE (1981 – 2021)**

Honouring the Past, Embracing the Future

**Published by KK Women's and Children's Hospital**

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*This book documents the story of the Department of Paediatric Surgery at KK Women's and Children's Hospital (KKH), from its beginnings at Singapore General Hospital 40 years ago, and through its subsequent growth as a specialty as part of a dedicated women's and children's hospital. It is closely intertwined with the growth of Singapore as a nation, and the growth of related healthcare specialties within and without KKH. This story is only possible with the contributions of many others. We hope that through this book, you will hear some of their voices.*





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# Message from Group Chief Executive Officer, SingHealth



As the largest healthcare provider for Singapore's children, SingHealth has achieved international standards in patient outcomes, training and research. We are proud to celebrate 40 years of incredible advancement in paediatric surgery in Singapore.

The practice of paediatric surgery began in 1981 at Singapore General Hospital, when a group of visionary surgeons stepped forward to meet growing patient needs and established a new specialty practice to benefit the children of Singapore. We pay tribute to these pioneers, including JJ Murugasu, VT Joseph, Prabhakaran Krishnan and Chua Wan Hoi, in this commemorative book.

The SingHealth Duke-NUS Academic Medical Centre, established in partnership with Duke-NUS Medical School, continually innovates to advance through research and education to improve patient care with an evidence-based, data-considered approach to clinical practice.

One such productive initiative is the VIVA-KKH Paediatric Brain and Solid Tumour Programme led by the Department of Paediatric Surgery at KK Women's and Children's Hospital (KKH). This inter-institutional initiative seeks to improve the outcomes of patients with childhood tumours in Singapore and the region, through multidisciplinary clinical care, translational research, population-based science, education and exchange initiatives.

With a long-standing tradition of contribution and commitment to global health, the KKH International Medical Programme has also conducted multiple

surgical missions to Cambodia, India, Indonesia, Laos and Myanmar in the last decade, working with surgeons in developing countries to elevate surgical care for children.

Under the auspices of the SingHealth Duke-NUS Surgery Academic Clinical Programme, the SingHealth Duke-NUS Global Surgery Programme aims to bring SingHealth's global health efforts to the next level by addressing gaps in surgical care capabilities in the region through capacity building, education and research.

I congratulate our paediatric surgeons for making an indelible mark in improving the health of our young patients over the past 40 years. As we forge ahead in this life-saving work, I look forward to many more years of impactful and transformative care for our future generations.

**PROFESSOR IVY NG**



**The practice of paediatric surgery began in 1981 at Singapore General Hospital, when a group of visionary surgeons stepped forward to meet growing patient needs and established a new specialty practice to benefit the children of Singapore.**

# Message from Chief Executive Officer, KK Women's and Children's Hospital

**M**y heartiest congratulations to the paediatric surgery practice in Singapore as it celebrates its 40th anniversary! Paediatric surgery is the unique branch of surgical practice that specialises in surgery for infants and children that started as a recognised surgical specialty at Singapore General Hospital in 1981. Paediatric Surgery was one of the departments that moved its practice to KK Women's and Children's Hospital (KKH) in 1997, when Singapore's first children's hospital was established.

At KKH, the Department of Paediatric Surgery continues to grow from strength to strength. For instance, in collaboration with our gynaecological colleagues, the department quickly built expertise as an early adopter of minimally invasive surgery for diagnostic and ablative procedures. Indeed, the Department of Paediatric Surgery at KKH has continued to lead in minimally invasive surgery ever since. Today, KKH is widely recognised as the centre for complex minimally invasive surgery for children in Singapore. Founded on the vast experience gained over the years, the scope of services offered today includes thoracoscopic pulmonary lobectomies, thoracoscopic oesophageal repairs, retroperitoneoscopic urological surgery and neoplastic resections, as well as complex reconstructive surgery such as for choledochal cysts.

In the relentless pursuit of excellence, Paediatric Surgery at KKH enrolled in the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) in 2020 to benchmark against the best practices of internationally renowned children's hospitals. Paediatric Surgery in KKH is fully committed to the journey of continuous improvement and to date, KKH remains the only Asian children's hospital in this programme.

The positive patient outcomes that have been hard won over the years are attributed to the dedication of the past and present multidisciplinary teams, passionately and tirelessly working hand in glove with all our stakeholders and partners. We are very grateful for the transformative work by the Department of Paediatric Surgery as it continues to bring life-saving hope and make life-changing differences to more children and their families. Kudos to the Department of Paediatric Surgery, you have done us proud!

**PROFESSOR ALEX SIA**



**Today, KKH is widely recognised as the centre for complex minimally invasive surgery for children in Singapore.**





*Life affords no greater responsibility, no greater privilege,  
than the raising of the next generation.*

**C Everett Koop** (1916–2013)

Paediatric Surgeon, 13th Surgeon General of the United States (1982–1989)

## Beginnings

**P**aediatric surgery is a young specialty with a paradoxically long history, its origins made possible only as a result of scientific advancements in modern medicine, and its evolution shaped by the global political and economic developments of the last century.

Modern paediatric medicine is only two centuries old and paediatric surgery, half as old. Yet, childhood ailments were common in descriptions of diseases in ancient history from the time of Hippocrates, around 400 BCE. In 50 CE, Roman physician Celsus, who authored *de Medicina*, was the first to suggest that children should be treated differently from adults<sup>1</sup>. Nevertheless, through the ages up to the 17th century, medical practice largely followed religion, folklore and traditional beliefs. The Renaissance period saw major scientific discoveries, aided by translations of prior knowledge from Arabic, Greek and Islamic scientists, that ushered in the science-based medical practice of the Age of Enlightenment<sup>2</sup>.

Paediatric medicine as a distinct specialty began in Europe in the late 18th century. Paris was then the centre of medical

progress and L'Hôpital des Enfants Malades, the world's first children's hospital, was established there in 1802<sup>1</sup>. Other major cities in Europe and North America followed suit: London in the United Kingdom (UK) in 1852; Philadelphia in the United States (US) in 1855, Toronto in Canada in 1875. In Asia, Mumbai (India), Beijing (China) and Tokyo (Japan) built dedicated children's hospitals only in the 20th century<sup>3</sup>. Additionally, many general hospitals began to develop dedicated paediatric units to serve the needs of the growing populations.

The world's first paediatric surgery unit started in 1844 at the Parisian L'Hôpital des Enfants Malades, followed by the establishment of similar surgical services at other major children's hospitals. However, up to the mid-1900s, there were few dedicated paediatric surgeons, and operations on infants and children were largely performed by general surgeons. A few famous pioneers in paediatric surgery restricted their practice to focus on children: Denis Browne, a British-trained Australian became the first British paediatric surgeon at the Great Ormond Street Hospital in 1926; William Ladd, the "Father of American Pediatric Surgery" at Boston Children's Hospital in

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## BEGINNINGS

1927. Initially, training in paediatric surgery required surgeons to apprentice for several months at one of the renowned centres. Formalised training programmes and accreditation only came later, starting in the 1960s in developed countries. In Asia, paediatric surgery became recognised in the latter half of the 20th century<sup>3</sup> (China 1949, Vietnam 1957, India 1963, Hong Kong 1967, Singapore 1981) but several countries with low- and middle-income economies still have few or no trained paediatric surgeons to this day.



I've had the happy opportunity to engage in paediatric surgery conferences... learning from an international group with varied experiences from different countries always proves deeply inspiring. Perhaps it is due to **the smaller global community of paediatric surgeons, but there appears to be consistently a lot of camaraderie and familiarity with each other.** In particular, at PAPS 2019 (pre-pandemic), having a very large group of paediatric surgeons singing the conference song together with lots of positive energy was really memorable.

**DR JAYNE CHIANG,**  
Paediatric surgery resident

The small number of paediatric surgeons worldwide, concentrated at only a few centres, has resulted in a close-knit international community. The earliest paediatric surgery associations – British Association of Paediatric Surgeons (BAPS) in 1954 and Pacific Association of Paediatric Surgeons (PAPS) in 1968 – welcomed members from all countries which fostered close multinational ties. As the specialty grew, more country and region-specific associations were established in the late 20th century and this prompted the creation of the World Federation of Associations of Paediatric Surgeons (WOFAPS) in 1974.



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## Paediatric Surgery Separates from General Surgery

*“Children are not small adults”.* This aphorism is recognised by all doctors who regularly treat children. From the mid-20th century, surgery as a medical discipline had subdivided into specialties largely based on anatomical regions (e.g. Neurosurgery, Orthopaedics) while general surgery continued to further subdivide by organ system (e.g. Hepatobiliary surgery, Urology). However, paediatric surgery evolved differently, as a surgical subspecialty that would define itself in response to the unique demands of babies and children.



I was privileged that others before me had already front-lined the establishment of paediatric surgery as a formal subspecialty when I began my journey, and they are the true pioneers. **Nevertheless, a misconception that children are simply adults in smaller packages in terms of their anatomy, physiology, pathology and psychology, was pervasive in earlier years.**

**ASSOCIATE PROFESSOR CAROLYN TAN,**

Pioneer paediatric surgeon; former Head,  
Department of Paediatric Surgery, KKH

Now that the toll of infectious diseases has been reduced with better prevention and treatment in most countries, present global estimates attribute one-third of all childhood deaths to a surgical condition<sup>4</sup>. Investment in paediatric surgical care is cost-effective, particularly for birth defects since surgery cures and/or greatly reduces the consequent disabilities. This leads to improved outcomes for the whole family and society gains a productive member when the child grows up<sup>5</sup>. Dedicated paediatric surgeons make a difference, achieving better outcomes than general surgeons, even for straightforward conditions like appendicitis<sup>6</sup>. Where there are insufficient paediatric surgeons, general surgeons with occasional paediatric practice will need adequate caseload for maintenance of skills to achieve comparative outcomes<sup>7,8</sup>.

## Paediatric Surgery Innovates Ahead of Adult Surgery

Although a younger specialty, paediatric surgery has been ahead of adult surgery in several aspects of surgical management.

Paediatric surgeons pioneered day surgery and early discharge from the hospital because they recognised the important psycho-social contribution of a familiar home environment to boosting postoperative recovery. Day surgery for hernias and other operations were performed by James Nicholl at the Glasgow Royal Hospital for Sick Children back in 1891<sup>3,9</sup>. In contrast, more than a century later, the majority of adult hernia operations in the UK remained as inpatient<sup>10</sup>. Similarly

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in Singapore, day case paediatric inguinal hernia operations were routine for a decade before adult practice followed suit. Ironically, there has been limited enthusiasm to follow the recently popularised Enhanced Recovery After Surgery (ERAS) general surgical protocols, since many of the ERAS recommendations like early feeding and same day admission have long been routine in paediatric surgical practice<sup>11</sup>.

The resilience and speedy healing of paediatric patients also prompted paediatric surgeons to try non-operative management for blunt abdominal trauma<sup>12,13</sup>. A decade later, surgeons adapted the paediatric management protocols to reduce unnecessary laparotomies for solid organ injuries in adults<sup>14,15</sup>.

Paediatric surgeons have always worked closely with paediatricians and other paediatric healthcare providers to provide holistic care. This interdisciplinary focus on children's growth and development ensured that ionising radiation risks in imaging were first recognised and actively minimised in paediatric patients<sup>16</sup>. For example, paediatric surgeons eschewed computer tomography (CT) scans widely used in adult practice for diagnosing abdominal conditions, relying instead on risk-stratification when escalating from ultrasound to imaging with radiation. With strong encouragement from paediatric disciplines, development of safer imaging technology and management algorithms has reduced ionising radiation for adults as well.



Diagnosing patients has become easier with the advancements in imaging. In the past, patients with abdominal pain suspicious for appendicitis did not have an ultrasound prior to operation; a decision was made based on clinical judgement. **Ultrasound imaging [in Singapore] was only available from the 1980s, with the Paediatric West Department being one of the first departments to acquire an ultrasound machine, perhaps even before the radiology department!**

**PROFESSOR PHUA KONG BOO,**  
Former Head, Gastroenterology Service, KKH

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## Paediatric Surgery Constrained

The most obvious specialty-specific characteristics of paediatric surgery involve the size and fragility of infants and children. In the early years, surgery on the very young and premature babies was limited by both surgical equipment and the safety concerns of anaesthesia. As both specialties evolved safer operative and anaesthetic techniques, morbidity and mortality rates decreased such that, nowadays, even premature babies under 1kg typically survive operations.



A 4-year-old child ran into my clinic for his annual consultation. He had no deficits except for some minor speech delay. This was a child who had been born on the threshold of viability – in those days taken as 400g. His gut had perforated, he was severely ill. His parents had been counselled by his doctors that he would face certain death. My team and I operated on him in the face of great odds, and the neonatal medical and nursing team nursed him back to health! It was one of those moments that reminded me how precious each of these babies are and how good they are at surprising us with their marvellous resilience!

**ASSOCIATE PROFESSOR LOW YEE,**

Former Head, Department of Paediatric Surgery, KKH

Size constraints previously caused paediatric surgery to lag behind adult surgical disciplines in minimally invasive surgery (MIS), also known as ‘keyhole surgery’; and endoscopy. In the last two decades with technological improvement in video-camera cables and miniature instruments, MIS has become routine for many simple and complex paediatric surgical operations. However, new concerns of subtle general anaesthesia effects



The small size of babies and young children pose major technical challenges for paediatric surgeons. The photograph above depicts a premature baby born at 24 weeks gestation, next to a normal adult female hand.

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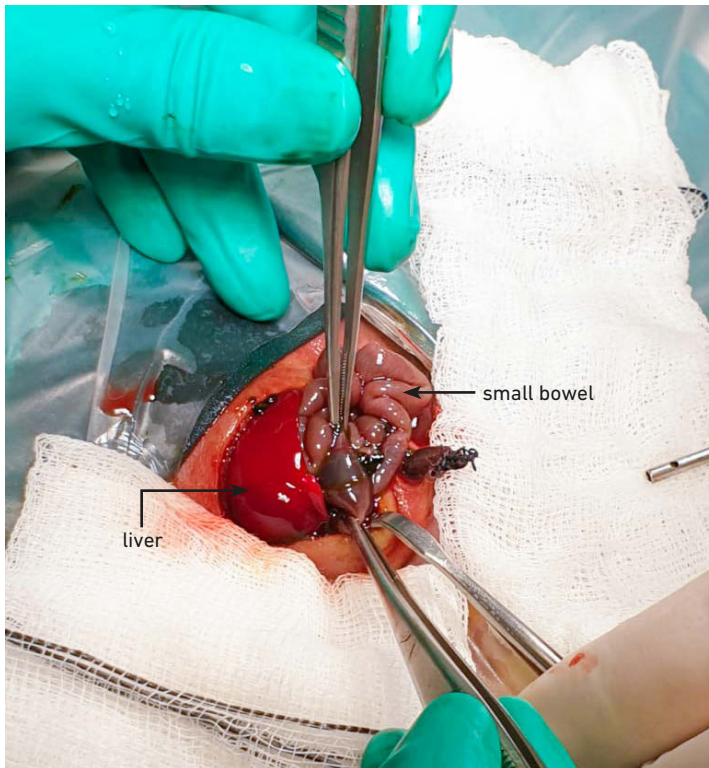
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on the developing brain<sup>17</sup> have recently tempered enthusiasm for elective MIS operations in early infancy.

Exponential increase in medical knowledge now drives the trend for subspecialisation in all fields of medicine. Proponents argue that high surgeon volume and specialisation are associated with improved patient outcomes<sup>18</sup> but “over-specialisation”

risks fragmented healthcare with higher costs<sup>19</sup>. Compared to adult surgery, paediatric surgery has remained fairly general but faces the same tension between developing subspecialist expertise without losing holistic expertise<sup>20</sup>. While there is data from rich countries for improved patient outcomes with subspecialised paediatric surgery<sup>21,22</sup>, globally there are relatively few trained paediatric surgeons. Most countries will rely on general surgeons for the bulk of paediatric surgical care and do not have the luxury of subspecialised paediatric surgeons. Nevertheless, the broad-based nature of paediatric surgery with many rare congenital conditions influences the caseload required for training, and the maintenance of clinical skills and research. Countries with enough trained paediatric surgeons need to restrict the extremely rare conditions to a few subspecialty centres to concentrate expertise<sup>22</sup>.



Operative photograph showing the baby's open abdomen with tiny organs gently held by forceps in the surgeon's gloved fingers.

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# Singapore Healthcare in the Early Years

## The Evolution of Singapore Healthcare

Singapore's healthcare system evolved in tandem with our progress from a third world to first world economy. At the turn of the century, when modern paediatric surgery was birthed in continental Europe, scientific medicine in colonial Singapore was practiced by generalist doctors trained in Britain or India<sup>23,24</sup>. The new government medical school produced the first seven graduates in 1910, who were expected to manage all medical and surgical conditions, ranging from dysentery to dentistry<sup>25</sup>. Malnutrition and communicable diseases formed most of the healthcare burden at this time. In response, the Maternal and Child Health Service (1907), School Health Service (1921) and the Public Dental Clinic (1929) were introduced. However, most of the local Chinese, Malay and Indian communities continued to rely on traditional medicine practitioners<sup>26</sup>. From 1926 until the Japanese Occupation (1942-1945), the few trained surgeons in Singapore were British imports who were assisted by local doctors at three general surgical units in the General Hospital (former name of Singapore General Hospital (SGH)) and Tan Tock Seng Hospital (TTSH)<sup>27,28</sup>.

After the Second World War, the colonial government implemented a 10-year Medical Plan to create more maternity and child clinics, hospital expansion with modernisation and mass population inoculation against infectious diseases. Upon attainment of self-governance in 1959, Singapore reorganised all medical and health services under the Ministry of Health (MOH). In 1962, the new government introduced mandatory

childhood immunisations, nutritional supplementation schemes and rolled out several nationwide health campaigns<sup>26</sup>, including the very effective family planning campaign that greatly changed the landscape for paediatric healthcare in the second half of the century since Singapore's independence in 1965.



From the mid-1950s, hospitalised children were housed in the Mistri Wing at SGH, built with the funding support of a generous donor.

Source: The SGH Museum

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Paediatric ward at Mistri Wing, SGH  
Source: The SGH Museum

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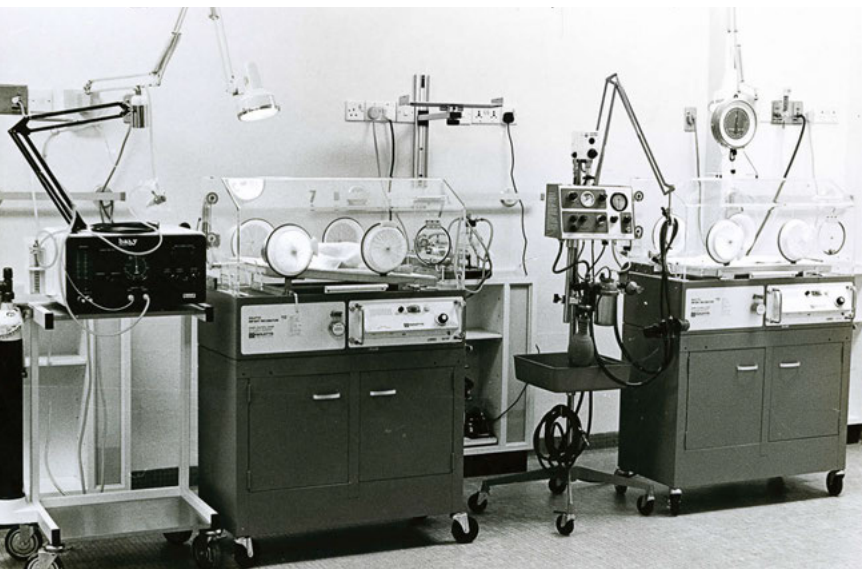
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The surgical ICU was opened on 16 September 1975. Incubators for babies and ICU equipment are shown here.

Source: The SGH Museum

## The Development of Specialty Practice

In the immediate post-war period, positions in the colonial medical service were reserved for British doctors. The only route for locals to attain specialist qualification was to train in the UK for a year or two before sitting the Royal Colleges' postgraduate examinations<sup>28</sup>. After 1958, arrangements with the Australian College of Surgeons and later with the Hong Kong Government, offered alternative shorter overseas stints leading to specialist surgery qualification.

By 1969, the School of Postgraduate Medical Studies was established to oversee local training of specialists<sup>28</sup>. The Academy of Medicine, Singapore was founded in 1957 as the professional corporate body of medical and dental specialists in Singapore, and the Chapter of Surgeons was inaugurated in 1966. The latter grew to become the College of Surgeons in 2004 with paediatric surgery forming one of its 10 Specialty chapters<sup>29</sup>.



A typical paediatric ward in Mistri Wing, SGH

Source: The SGH Museum

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The surgeons before me were all sent to the UK to train. At the end of their training and examinations, they still had to work a few years in Singapore before they were considered “surgeons” (the UK examinations were like entrance examinations). Fortunately for a group of us, the then-President of the Australasian College of Surgeons, Sir Ian Douglas Miller, wanted to link up with Singapore and he invited Dr Yeoh Ghim Seng to send the first batch of surgeons to train in Australia. He promised to take good care of us, train us and see us through the examinations. This would be an exit examination and we would be considered fully trained surgeons upon return to Singapore. You could consider us a lucky lot. I remember our time together vividly. There were five of us aspiring surgeons. I am now 94 years old and sad to say, I’m the only one of our group left to tell the tale.

**DR JJ MURUGASU,**

Pioneer general surgeon with substantial paediatric surgery practice



Dr JJ Murugasu on obtaining his Fellowship of the Royal Australasian College of Surgeons

Development of local medical specialist services began in the 1960s with the development of laboratory services, followed by medical disciplines such as renal medicine, cardiology and haematology<sup>23</sup>. Paediatrics had already been well established pre-war with inpatient services at the General Hospital since 1921<sup>29</sup>. Neonatology developed as a paediatric subspecialty shortly after the war but was only recognised by the Specialist Accreditation Board in 2006<sup>30</sup>. Meanwhile, in Surgery, there had been early specialisation in a few fields due to special interests of the British general surgeons heading Surgery

units, namely Ophthalmology (1935), Orthopaedics (1952) and Otorhinolaryngology (1957). This was followed by the establishment of other specialist units: Cardiothoracic Surgery (1966), Plastic and Reconstructive Surgery (1971), Neurosurgery (1972), Paediatric Surgery (1981), Hand Surgery (1985) and Urology (1988)<sup>28</sup>. Within each recognised specialty, particularly General Surgery, some departments were further divided into subspecialised services by anatomical region (e.g. Head and Neck) or focus (e.g. Trauma).

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# Paediatric Surgery in Singapore

## Birth of Paediatric Surgery in Singapore

The post-war baby boom had made Singapore's national maternity hospital, Kandang Kerbau (KK) Hospital, the world's busiest maternity hospital between 1950 to 1970<sup>31</sup>. During this period, infant mortality rates decreased rapidly, contributed by obstetric advancements in antenatal care, domiciliary delivery services and the introduction of neonatal incubators in Singapore in 1958<sup>31</sup>. Compulsory childhood vaccinations and other major paediatric advancements in treating neonatal jaundice, malnutrition, pneumonia and infective gastroenteritis greatly reduced childhood morbidity and mortality<sup>32</sup>. Hence, the nation could now turn its attention towards surgically correctable conditions such as congenital malformations. Singapore's highly successful family planning campaign also resulted in smaller families which intensified parental pressure for quality paediatric healthcare.

During the 1960s and 1970s, paediatric surgery in Singapore was performed at SGH by general surgeons with a special interest in children's surgery. One of the first five local general surgeons who trained in Australia on the Colombo Plan was additionally trained in paediatric surgery but soon left the service. Afterwards, his contemporary Dr JJ Murugasu managed most of the cases in SGH until younger paediatric surgeons were trained.



Dr JJ Murugasu as a young surgeon, operating with Dr Yeoh Ghim Seng in SGH (left and right of the operating table respectively).

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I was on call one night and a baby was brought in with ectopia cordis [an extremely rare condition in which the baby is born with the heart partially or fully outside the chest]. We did our best over the next few hours and fortunately, there was enough skin to cover and protect the heart. Wonder of wonders, coincidence of coincidences, Dr Yeoh Ghim Seng came in the next morning, heard about our night cases, and gave us the breaking news – ten surgeons in America had that same night (their daytime) spent the whole day closing up an ectopia cordis in a baby! We had a good laugh at our own gung-ho-ness. Maybe theirs was a more difficult case and they had better techniques.

I remain grateful for Dr Wong Hock Boon's trust and confidence in me; sending me so many babies to operate on. After a while, from sheer numbers, imperforate anus became my "specialty". I pioneered the technique of injecting dye into the anal dimple to identify the pouch end of the rectum as well as any fistula<sup>32</sup>. I am thankful to have as a friend a great radiologist, the late Dr Chow KW who was always willing to participate in my ideas.

**DR JJ MURUGASU,**

Pioneer general surgeon with substantial paediatric surgery practice

In 1970, the National Committee on Specialisation recommended the development of paediatric surgery as a separate discipline and this led to the training of the first dedicated paediatric surgeons in Singapore, Dr VT Joseph and Dr Chua Wan Hoi, in 1974. They worked together with the general surgeons in SGH to provide paediatric surgical care for the nation. The first independent paediatric surgery department led by Dr Joseph was inaugurated on 5th Oct 1981 at SGH<sup>33</sup>.

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Dr Chua Wan Hoi, seated, extreme right, in a picture taken with his colleagues at SGH



My late father (Dr Chua Wan Hoi) was one of the first trained paediatric surgeons in Singapore. He was instrumental in helping to establish the Paediatric Surgical Unit at SGH (then named Outram Road General Hospital) under its Department of Surgery. As a pioneer general paediatric surgeon, he worked tirelessly, correcting congenital malformations in infants, as well as performing emergency operations such as appendicectomies, explorations for testicular torsion and repairs of irreducible inguinal hernias in children. With no computed tomography or magnetic resonance imaging at that time, intra-operative surprises were the order of the day, with rare anomalies like intestinal duplication discovered only at laparotomy.

#### DR CHRISTINA CHUA,

(General Practitioner) on her late father, Dr Chua Wan Hoi, pioneer paediatric surgeon



Source: The SGH Museum

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One of the paediatric wards in SGH  
Source: The SGH Museum

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A/Prof VT Joseph hosting a ministerial visit, 1982  
Source: The SGH Museum



Official opening of the playroom in the SGH paediatric surgical ward 55 in 1994  
Source: The SGH Museum



Prof Ho Lai Yun at lunch with Mr Naf Fritz in Singapore in 2017. Mr Fritz is the earliest paediatric surgery survivor of congenital diaphragmatic hernia with severe pulmonary hypertension [part of diaphragm is missing, associated with decreased lung function].



Most memorable event? I remember we operated on a baby with severe congenital left diaphragmatic hernia who was ventilated post-operatively at SGH Ward 55. Before this, no baby with such a degree of severity survived, but he did. The parents were Austrians and they transferred the baby from Mount Elizabeth Hospital to SGH because they heard of the care available at SGH at that time. The baby's name is Naf Fritz. He had pulmonary hypertension and nobody expected him to pull through. When the parents brought him home, he was still cyanosed [blue]. He is now in his thirties, happily married, and doing skiing every winter in the Alps.

#### PROFESSOR HO LAI YUN,

Emeritus Consultant and former Head, Department of Neonatology, SGH;  
Senior Consultant and Advisory Board Director, Department of Child Development, KKH

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A/Prof VT Joseph, first Head of the newly formed Department of Paediatric Surgery at SGH



Prof VT Joseph did not choose to do Paediatric Surgery – his talent as a superb surgeon chose him. He took up the challenge, and Singapore has not looked back. He was a strict master trainer, and good to have as a friend if you needed bailing out in the operating theatre. He loved to be in the operating theatre, and regularly would list cases on public holidays and the eve of such events. As trainees in those days, it was our duty to be there. He provided great supervision. He would sit in the corner and walk back and forth occasionally and [was always] ready to bail us out if we needed it... [or] to prevent us from getting into trouble in the first place.

**ASSOCIATE PROFESSOR ANETTE JACOBSEN,**

Former Head, Department of Paediatric Surgery, KKH, on A/Prof VT Joseph, pioneer paediatric surgeon who headed the first paediatric surgery department in Singapore



As a medical student in the early '70s, I had the privilege of witnessing the surgical care of neonates, infants and young children undertaken by the Departments of General Surgery A (University) and B (Government) in the old SGH. The standout surgeon who pioneered paediatric surgical management was Prof VT Joseph, who was a senior surgeon in Surgery B. He was appointed the first head of the paediatric surgical unit in 1981 and remained so till we moved over to KKH in 1997. Many innovative and new surgical procedures were developed by him... I am eternally grateful to Prof Joseph and his department in helping me to develop paediatric otolaryngology as a subspecialty when I returned in 1991 from fellowship training in the UK.

**ASSOCIATE PROFESSOR ABHILASH BALAKRISHNAN,**

Paediatric otolaryngology (Ear, Nose and Throat) surgeon SGH and KKH, on A/Prof VT Joseph



Among junior medical officers and trainees, he is touted as... the best pair of hands Singapore ever [had]. Being Mr Joseph's assistant in surgery has always [impressed] me... his calmness, decisiveness, confidence, skills, and his very steady pair of hands.

**DR CHUI CHAN HON,**

Former Head, Department of Paediatric Surgery, KKH; currently in private practice, on A/Prof VT Joseph

1800s to 1900s  
Specialty develops in Europe,  
America followed by Asia

1921  
First paediatric inpatient ward opens  
in General Hospital

1956  
Mistri Wing opens in SGH



Dr Sim Chiang Khi,  
currently in private  
practice



I completed my general surgery (GS) training in the early 1980s and was then posted to Alexandra Hospital where Prof Tan Kheng Wee headed the paediatric neonatal unit. There were a lot of neonatal referrals, but senior GS consultants were not too excited to review neonates. As a result, I was always called to review sick babies, assess premature babies for acute abdomen, perform venous cut downs for vascular access and more. Paediatric surgery was not formally taught in school and neither was it part of GS training, hence I felt inadequate when dealing with neonatal patients. When MOH opened an advanced surgical training (AST) position in paediatric surgery in 1985, I decided to apply and have never looked back since.

**DR SIM CHIANG KHI,**

Pioneer paediatric surgeon, now in private practice



The late Dr Ong Nai Theow  
with his patient (1980s)



I think paediatric surgery was special to my dad (Dr Ong Nai Theow) as it was a marriage of two things he genuinely loved – surgery, and babies/children. While I cannot recall any one particular event, I do remember the emotions that surrounded the successful cases – that he came home happy and rewarded despite a long day (or night), having made a difference to a child's life; and that dedication to his work was inspiring to me. In a way, it was an honour to have been one of the first few members of a fledgling specialty, but one of the challenges was that it seemed (back then) to be less “prestigious” than adult general surgery, even though paediatric surgeons could perform a much wider range of surgeries. I'm sure his hope would be for the specialty to continue to attract talent, expand further, and achieve the mainstream recognition that it deserves!

**DR CAROLINE ONG YM**

(Anaesthetist) on her late father Dr Ong Nai Theow,  
pioneer paediatric surgeon

1960s

General surgeons perform  
paediatric operations

1981

Department of Paediatric Surgery  
established at SGH

VT Joseph appointed Head of Department

1985

Paediatric surgery service in the new NUH  
General Surgery Department

K Prabhakaran appointed Head of Service



Doctors who formally trained in paediatric surgery in the initial years included Dr Prabhakaran Krishnan, Dr Sim Chiang Khi, Dr Cheah Siew Leng and Dr Ong Nai Theow. In 1985, a new general hospital, National University Hospital (NUH), was set up with a general surgery department that offered the nation's second public paediatric surgery service, which was led by Dr Prabhakaran<sup>34</sup>.

At SGH, the surgical team was joined later by Dr Carolyn Tan and Dr Grace Tan, and subsequently Dr Anette Jacobsen. Dr Jacobsen was the first to be awarded the local Fellow of the Academy of Medicine, Singapore (FAMS) in Paediatric Surgery in 1996. Dr Carolyn Tan took over from Dr VT Joseph to become the first female head of department in 1997. These intrepid female surgeons, all working mothers, no doubt blazed the trail for other female surgical trainees. The current Department of Paediatric Surgery at KKH (KKH Paediatric Surgery) is one of the few unique surgical departments in the world boasting more female than male surgeons!



Our pioneer surgeons Dr Cheah Siew Leng (extreme left), Dr Ong Nai Theow (second from left) and Dr Sim Chiang Khi (extreme right) at a dinner with then Permanent Secretary, Ministry of Health, Mr Kwa Soon Bee (second from right). Standing next to Mr Kwa is Dr Yap Te-Lu (with her husband Dr John Chen on her right).

1981

Department of Paediatric Surgery  
established at SGH

VT Joseph appointed Head of Department

1985

Paediatric surgery service in the new NUH  
General Surgery Department

K Prabhakaran appointed Head of Service

1989, 1991

First paediatric kidney transplant;  
first paediatric liver transplant at NUH



A/Prof Carolyn Tan was the first female Head of Department in 1997.  
A/Prof Carolyn Tan (centre, checked shirt) pictured here with department staff and ward nurses in SGH, shortly before the move to KKH. Other paediatric surgeons in the picture are (from left to right): Dr Ong Nai Theow, Dr Grace Tan, A/Prof Anette Jacobsen, Dr Yap Te-Lu and A/Prof Low Yee.



I chose paediatric surgery because I loved the patients! They would recover so quickly once you did the correct operation for them without the post-operative complications more commonly seen in adults like deep vein thrombosis, pneumonia, acute myocardial infarctions or strokes. And there is no pretence or malingering with paediatric patients. The early days were tough as we had to manage our patients in the intensive care unit (ICU) ourselves! I had no ICU training, no real knowledge of how to handle the ventilators and settings for the machines. Fortunately, we also had really good ICU-trained paediatric nurses to help us, and resilient patients to make up for our errors.

#### DR GRACE TAN,

Pioneer paediatric surgeon, currently in private practice



A/Prof Anette Jacobsen was the first to be awarded the local Fellow of the Academy of Medicine, Singapore (FAMS) in Paediatric Surgery in 1996. Pictured here addressing the audience at the 23rd Asian Association of Pediatric Surgeons Conference in Seoul, Korea (2012).

1991

First paediatric MIS 'keyhole' surgery (undescended testicle)

Day surgery for paediatric hernias became routine

1997

New KK Women's and Children's Hospital opens.

SGH Paediatric Surgery becomes KKH Paediatric Surgery

Carolyn Tan appointed Head of Department

1997-2008

Increasingly complex paediatric MIS 'keyhole' operations offered





The first night we were operational in KK Women's and Children's Hospital, many families turned up at our Emergency Department, many with minor complaints. We were not yet fully staffed and worked really hard that evening. I remember asking a dear grandmother why her family had come, and she replied, "Just to see the hospital, lor!" I dubbed it the 'Takashimaya Syndrome' (referring to huge curious crowds at openings of shopping centres in Singapore).

**ASSOCIATE PROFESSOR CAROLYN TAN,**

Pioneer paediatric surgeon; former Head, Department of Paediatric Surgery, KKH



The new KKH, with a Women's wing and a Children's wing

1981

Department of Paediatric Surgery  
established at SGH  
VT Joseph appointed Head of Department

1985

Paediatric surgery service in the new NUH  
General Surgery Department  
K Prabhakaran appointed Head of Service

1989, 1991

First paediatric kidney transplant;  
first paediatric liver transplant at NUH





Present day paediatric surgical ward - Ward 55, KKH

In the 1990s, MOH decided to rebuild the old KK maternity hospital on new premises and expand its mission to include children's healthcare. The old hospital's original Obstetrics and Gynaecology (O&G) and Neonatal departments were consolidated with major paediatric departments from three hospitals (SGH, Alexandra Hospital (AH) and TTSH) to form the KK Women's and Children's Hospital (KKH). On 10 May 1997, the SGH Paediatric Surgery Department moved into the new hospital to begin a new era of paediatric-specialised multidisciplinary collaboration.



Dr Jennifer Lee (then CEO of KKH) leading her team on the symbolic walk signifying the move to the new KKH premises in 1997

1991

First paediatric MIS 'keyhole' surgery (undescended testicle)

Day surgery for paediatric hernias became routine

1997

New KK Women's and Children's Hospital opens.

SGH Paediatric Surgery becomes KKH Paediatric Surgery

Carolyn Tan appointed Head of Department

1997-2008

Increasingly complex paediatric MIS 'keyhole' operations offered

## Growing the Specialty: The Early Years in SGH and KKH

Starting from 1981, having designated paediatric surgery inpatient wards in SGH meant that emergency and elective perioperative care was driven by paediatric surgeons rather than paediatricians. Together with dedicated operating lists, this improved nursing expertise in surgical care for infants and children<sup>35</sup> for better patient outcomes. The paediatric surgical caseload rapidly increased in complexity and tripled to 1935 cases in just over three years<sup>33</sup>.

The initial focus for the department was to train more paediatric surgeons for Singapore. An arrangement in 1985 with the Royal Children's Hospital (RCH) in Melbourne facilitated staff to be sent there regularly for training. As it grew, the department developed expertise to train new paediatric surgeons locally; but continued to send staff for overseas attachments to learn complex skills, under the MOH Health Manpower Development Programme (HMDP). Since the 1990s, it has remained a deliberate choice that Singapore's young paediatric surgeons are sent to different centres around the world for exposure to alternative styles of management.



Back in the 80s, there was no respiratory therapist, hence setting up of ventilators and airway management were part of ICU nurses' responsibilities. We always needed to actively engage in case discussion with the paediatric surgeons and intensivists during daily ward rounds. Our stress level would increase especially during the Grand Ward Round, led by the Head of Surgery, where nurses are expected to give our inputs on a patient's progress and plan. Looking back, that was how it shaped us, to become a confident and competent nurse.

The first time when I received a newborn with a large gastroschisis [defect in abdomen exposing internal organs], it was a very nervous and memorable experience for me. The surgeon-in-charge was very patient and she guided me throughout the various stages of the entire care process. SGH Ward 55 Paediatric ICU was one of my favorite postings. There was great teamwork, strong support from supervisors and camaraderie among the colleagues.

### MS NG GAIK NAI,

Chief Nurse, SGH, Deputy Group Chief Nurse, SingHealth, former Chief Nurse, KKH



Resuscitating a newborn with a similar condition of abdominal wall defect (omphalocele)

1981

Department of Paediatric Surgery established at SGH

VT Joseph appointed Head of Department

1985

Paediatric surgery service in the new NUH General Surgery Department

K Prabhakaran appointed Head of Service

1989, 1991

First paediatric kidney transplant; first paediatric liver transplant at NUH





**The introduction of air enema reduction meant that many young children with intestinal obstruction were spared major abdominal operations. The other major change in clinical practice in the 2000s, in collaboration with our radiology colleagues, was the use of ultrasound scans for boys with scrotal pain. This allowed testicular torsion (twisted testis causing gangrene) to be more accurately diagnosed, and the number of surgical explorations were drastically reduced.**

**ASSOCIATE PROFESSOR LOW YEE,**  
Former Head, Department of Paediatric Surgery, KKH

New ideas and procedures have been introduced with each returning surgeon: implantable central venous access devices, gastrostomy button and air enema reduction for intussusception from RCH Melbourne (1992)<sup>34</sup> as well as operative techniques for hypospadias repair from Hospital for Sick Children, Toronto (1998) and Great Ormond Street Hospital, London (2017). Other returnees also introduced improved clinical practice systems they had learned; such as protocol-driven paediatric oncology practices, multi-disciplinary mini-tumour boards from St Jude's Children Research Hospital (1999/2014), multidisciplinary vascular malformation clinics and same day admission processes from RCH Melbourne (2002, 2003).

The department also leveraged on proximity with early adopters among their gynaecology colleagues in KKH to develop MIS for children as it was developing in adult surgical practice. When paediatric MIS was first introduced in Singapore in 1991, it was limited to simple diagnostic laparoscopy for non-palpable undescended testicles. Gradually, development of smaller equipment and paediatric anaesthesia innovations made more types of operations possible. Laparoscopic paediatric appendectomy,



The biggest challenge in the 1980s was the lack of manpower and resources dedicated to treating paediatric conditions in many other departments, namely Pathology, Anaesthesiology, Intensive Care and Radiology. For example, in treating Hirschsprung's disease, there was no pathologist available in the operating theatre. Frozen specimens taken to identify the transition zone had to be hand-carried by the porters to the histopathology laboratory in another building. Furthermore, the pathologist was not trained to read such samples and often multiple specimens had to be done. This meant a long time spent waiting for results while the child was kept under general anaesthesia.

**DR SIM CHIANG KHI,**  
Pioneer paediatric surgeon, now in private practice

**1991**  
First paediatric MIS 'keyhole' surgery (undescended testicle)  
Day surgery for paediatric hernias became routine

**1997**  
New KK Women's and Children's Hospital opens.  
SGH Paediatric Surgery becomes KKH Paediatric Surgery  
Carolyn Tan appointed Head of Department

**1997-2008**  
Increasingly complex paediatric MIS 'keyhole' operations offered

first performed in 1997<sup>35</sup>, became routine by 2002, even for complicated appendicitis. More complex MIS operations such as laparoscopic fundoplication and laparoscopic splenectomy were introduced over time.

Local surgeons were not just sent overseas to acquire cutting edge skills, the department also regularly invited internationally renowned experts to upgrade local knowledge and operative expertise. Over the years, multiple experts from the US, Europe and Asia have visited. MIS operations in children was one key area that benefited from these proctorships. For example, the first complex MIS paediatric operation, a laparoscopic choledochal cyst operation in a 9-year-old child, was demonstrated by Professor Klaas Bax from the Netherlands

in 2007. This catalysed the subsequent performance of many more such operations and presently KKH has the largest series of such cases locally. Other significant tertiary MIS operations for which the department has accumulated the largest local experience include retroperitoneoscopic nephrectomy (2006) and thoracoscopic lung resections (2008).



Visiting Professor Klaas Bax with Dr Chiang Li Wei and Dr Rambha Rai at an animal workshop to train complex MIS skills, 2007



Visiting Professor Klaas Bax with 9-year-old Amelia Tan (now a nursing graduate), soon after the first successful laparoscopic choledochal cyst operation, a complex MIS operation requiring advanced technical skills

1981

Department of Paediatric Surgery  
established at SGH  
VT Joseph appointed Head of Department

1985

Paediatric surgery service in the new NUH  
General Surgery Department  
K Prabhakaran appointed Head of Service

1989, 1991

First paediatric kidney transplant;  
first paediatric liver transplant at NUH





Dr Amos Loh with A/Prof Low Yee at a subsequent laparoscopic cholecyst operation



Prof Ramnath Subramaniam



I benefited from the resources available to develop my minimally invasive surgical skills and went on to publish one of the earliest series on thoracoscopic intervention for complicated pneumonia in childhood. I also was presented with the opportunity to conduct a randomised controlled two-arm study comparing suture-less circumcision vs a sutured technique... to date I carry on from what I learnt and am able to give some of the best cosmetic appearances to a circumcised penis (hence my nickname – Designer Willy Surgeon!). KKH Paediatric Surgery is unique and well-resourced for high quality care for the children in Singapore and the region.

**PROFESSOR RAMNATH SUBRAMANIAM,**

Paediatric surgeon, Leeds University UK, on his time in Singapore at KKH Paediatric Surgery during the early years of his career

**1991**

First paediatric MIS 'keyhole' surgery (undescended testicle)

Day surgery for paediatric hernias became routine

**1997**

New KK Women's and Children's Hospital opens.

SGH Paediatric Surgery becomes KKH Paediatric Surgery

Carolyn Tan appointed Head of Department

**1997-2008**

Increasingly complex paediatric MIS 'keyhole' operations offered



## Meanwhile, at NUH...

Paediatric surgery at NUH, helmed by Dr Prabhakaran, grew from a service to a department in 2001. The smaller general caseload allowed the department to focus on developing the national paediatric kidney and liver transplant programme, leveraging on NUH solid-organ transplant expertise. The first paediatric kidney transplant and liver transplant were carried out in NUH in 1989 and 1991 respectively<sup>36</sup>, and up to the current time, the department at NUH has performed 150 paediatric liver transplants. Dr Prabhakaran and his team have also helped to set up paediatric transplant programmes in Indonesia and Myanmar.



Prof Prabhakaran, the first Head of Department of Paediatric Surgery at NUH. He was instrumental in the development of the national liver and paediatric transplant programmes.



The most memorable event in my paediatric surgical career was setting up the Department of Paediatric Surgery at the National University Hospital (NUH) in 2001 and going on to helm the department for the next fifteen years. I led my team in all types of cutting-edge paediatric surgery. My pioneering work in canine and porcine models of liver transplantation led to the first human liver transplant programme in Singapore at NUH. I am immensely proud of the many “firsts” including the first paediatric liver transplant in 1991, first live donor paediatric liver transplant in 1996 and the first “split” liver transplant the very next year.

**It was an uphill struggle to set up a paediatric transplant unit in NUH during the early years. At the time, the national blood bank system was less developed than it is now and had insufficient blood reserves to support a liver transplant operation – I remember we had to personally canvass and run a blood donation drive from the patient’s relatives and well-wishers in order to get the transplant operation going! Fortunately, as time passed, our blood donation and banking system became more sophisticated and this is no longer necessary.**

We have since gone on to help set up paediatric liver transplantation programmes in Rumah Sakit Umum Pusat Doktor Kariadi in Semarang, Indonesia, Cipto Mangunkusumo Hospital in Jakarta and a paediatric kidney transplant programme in Yangon Children’s Hospital, so we have come quite far since those early days!

### EMERITUS PROFESSOR K PRABHAKARAN,

Pioneer paediatric surgeon; former Head, Department of Paediatric Surgery, NUH

1981

Department of Paediatric Surgery established at SGH  
VT Joseph appointed Head of Department

1985

Paediatric surgery service in the new NUH General Surgery Department  
K Prabhakaran appointed Head of Service

1989, 1991

First paediatric kidney transplant;  
first paediatric liver transplant at NUH





Prof Prabhakaran at the wedding of the first liver transplant patient

Source: [The Straits Times] © Singapore Press Holdings Limited. Permission required for reproduction.

1991

First paediatric MIS 'keyhole' surgery  
(undescended testicle)

Day surgery for paediatric hernias  
became routine

1997

New KK Women's and Children's Hospital opens.

SGH Paediatric Surgery becomes  
KKH Paediatric Surgery

Carolyn Tan appointed Head of Department

1997-2008

Increasingly complex paediatric MIS  
'keyhole' operations offered





Paediatric surgeons from KKH, NUH and the private sector, together with regional surgeons at the Southeast Asia Paediatric Endoscopy Group (SEAPEG) conference organised in Singapore 2008

The NUH paediatric surgeons continue to work closely with KKH counterparts to provide training and continual professional development in paediatric surgery in Singapore. Both departments are represented in the national Residency Advisory Committee (RAC) - previously the Specialist Training Committee (STC) - that oversees training and examinations, and the Chapter

of Paediatric Surgeons in the College of Surgeons (Academy of Medicine Singapore). The Chapter maintains close ties between public and private sector surgeons by hosting regular academic activities like journal clubs and conferences.

1997-2008

Increasingly complex paediatric MIS 'keyhole' operations offered

1999

Anette Jacobsen appointed Head of Department

2002

KK Outreach to Kids fund established





Paediatric surgery in Singapore has come a long way in the last four decades. While we are seeing more collaboration between the three groups (KKH, NUH and private practice) with more regular chapter meetings in recent years, I would like to see the specialty achieve greater heights together with regular cross pollination of ideas and shared experiences. There is certainly “more than one right way” to manage many paediatric surgical cases and as a group, we can draw on each other’s experience and knowledge to provide the best care for our young patients.

**DR SIM CHIANG KHI,**  
Pioneer paediatric surgeon, now in private practice



Maintaining close ties between NUH and KKH - Dr Dale Loh (current Head, Department of Paediatric Surgery, NUH), on overseas conference day excursion, together with Dr Rambha Rai, Dr Jayne Chiang, Dr Yap Te-Lu and A/Prof Shireen Nah (formerly at KKH, now practising in Malaysia)

2004

Chapter of Paediatric Surgeons in College of Surgeons, Academy of Medicine Singapore

2005

Same day hospital admission for major operations

2006

Chui Chan Hon appointed Head of Department

# Modern Paediatric Surgery in Singapore

## Collaboration: The KKH Years

The new purpose-built hospital with child-centric facilities presented a great opportunity for expansion of surgical services in close collaboration with multiple disciplines. Co-location enhanced convenient referrals: paediatric surgeons could join obstetricians and neonatologists for foetal anomaly antenatal counselling to prospective parents.

KKH now provided the full range of paediatric surgical care, including cardiothoracic surgery, orthopaedics, neurosurgery, plastics and reconstructive surgery, ophthalmology and otolaryngology. Previously, such expertise was limited to one or two specialists per discipline, located in different hospitals in Singapore, who were largely adult-trained surgeons with occasional paediatric practice. Coming together to form the KKH Division of Surgery stimulated growth and training in all these related specialties.

The increased paediatric surgery caseload at the new hospital warranted a dedicated paediatric surgery outpatient clinic and the KKH Children's Surgery Centre (CSC) started in 2008. CSC facilitated expansion of our paediatric urodynamic services and offered same-day urotherapy counselling from 2012. The trained nurses and clinic staff contribute greatly to seamless transition between inpatient and outpatient care whenever patients are admitted or discharged from hospital. The nurse-led specialty paediatric wound and stoma services manage challenging dressing changes for tiny babies and fretful children.



Children Surgery Centre (CSC) clinic staff with Dr Joyce Chua (centre in red), now in private practice

Similarly, the critical mass and economies of scale in KKH helped develop new capabilities in other medical, nursing and allied healthcare disciplines<sup>31</sup> relevant to paediatric surgery. A child undergoing an operation could have reduced stress because of minimised fasting duration, distraction with games during induction of anaesthesia and the company of the caregiver in the operating theatre.

2002

KK Outreach to Kids fund established

2004

Chapter of Paediatric Surgeons in College of Surgeons, Academy of Medicine Singapore

2005

Same day hospital admission for major operations





CSC, a dedicated paediatric surgery clinic, opened in 2008

**2006**  
Chui Chan Hon appointed  
Head of Department

**2008**  
KKH Children's Surgery Centre opens

**2009**  
Low Yee appointed Head of Department





[An impactful change was SGH] management allowing the parents to accompany the child into OT [operating theatre]. Of course, we now had to cope with managing an awake child with the parents looking on. The kids were no longer sedated and anaesthetists needed to find creative ways to distract the child; bubbles, toys, stickers, scented masks etc... The move to KK Women's and Children's hospital [meant there was] finally a hospital which puts children as priority. A conducive environment that allowed the dedicated team of medical and nursing staff to concentrate on looking after the children. It was refreshing having a supportive administration, and not having to think about competing with adult patients for resources. Under the umbrella of the Division of Surgery, the Department of Paediatric Anaesthesia and the surgical specialties allowed open discussion and problems to be sorted out unfettered.

**ASSOCIATE PROFESSOR AGNES NG,**  
Former Head, Department of Paediatric Anaesthesia, KKH

The hospitalisation experience is improved by Child-Life Therapists utilising play, music and art to calm and soothe fretful children. Our complex patients with multiple anomalies benefit from multidisciplinary clinics such as the Feeding Clinic and Home Care Clinic. Paediatric medical subspecialties have flourished with new paediatric expertise in intensive care, cardiology, hematology and oncology, gastroenterology and nephrology. This has promoted specific disease-management protocols and driven research collaboration between the departments of paediatric medicine and paediatric surgery.



The best thing that KK Women's and Children's Hospital brought along was the team of compassionate, hardworking, resilient, and collaborative paediatric surgery colleagues. Thank you for always being there for the patient when there is a need.

**PROFESSOR CHAY OH MOH,**  
Emeritus Consultant, Respiratory Medicine Service, former Chair, Division of Medicine, KKH

2005

Same day hospital admission for major operations

2006

Chui Chan Hon appointed Head of Department

2008

KKH Children's Surgery Centre opens



**The most memorable event I would treasure in my heart is the team spirit - the 'Kampong Spirit' as it is locally called - the dedication, commitment and understanding between the doctors in the Neonatology, Paediatric Anaesthesia and Paediatric Surgery departments spanning over two decades and they underpin the secret of our success in neonatal surgery. Paediatric Surgery would not be what it is today without the partnership and collaboration between the above three departments and also all our colleagues from the Division of Medicine, Children's ICU, Nursing and Allied Health, and also the Administrative Support services. We faced several challenges during the early days of our journey at the new premises, but resilience and perseverance helped us to overcome them.**

**PROFESSOR VICTOR SAMUEL RAJADURAI,**  
Former Head, Department of Neonatology, KKH

Improved networking among paediatric surgical subspecialties within KKH has helped create new links with the wider surgical fraternity in the rest of Singapore. This facilitated a formal Adolescent Transition Clinic (2016) for patients with chronic conditions who need to "graduate" to adult care. Maintaining close ties with adult subspecialty surgeons is important in developing paediatric subspecialty expertise since we can readily tap on their experience for rarely seen paediatric anomalies. In 2011, the department re-organised as four teams to encourage subspecialty focus (Hepatobiliary, Thoracic, Urology and Oncology) even while all continue to perform general and neonatal surgery because of caseload breadth and volume.

## Academic Mission: Part of the SingHealth Academic Medical Centre

The SingHealth cluster, including SGH and KKH, was formed in 2000 when MOH organised Singapore's public healthcare institutions into different healthcare clusters. Gradually, the different hospital systems were unified under the One SingHealth multi-site approach to synergise and leverage on each institution's capabilities. A decade later, SingHealth partnered with Duke-NUS Medical School to develop as an academic medical centre by setting up Academic Clinical Programmes (ACPs), institutes of research and education and SingHealth Duke-NUS Disease Centres (SDDC)<sup>37</sup>.

**2009**  
Low Yee appointed Head of Department

**2010**  
SingHealth Academic Medicine focus  
The national specialty training system changes, paediatric surgery is included in GS and Urology Residency programmes

**2011**  
Team-based reorganisation of department  
KKH Trauma Registry is set up



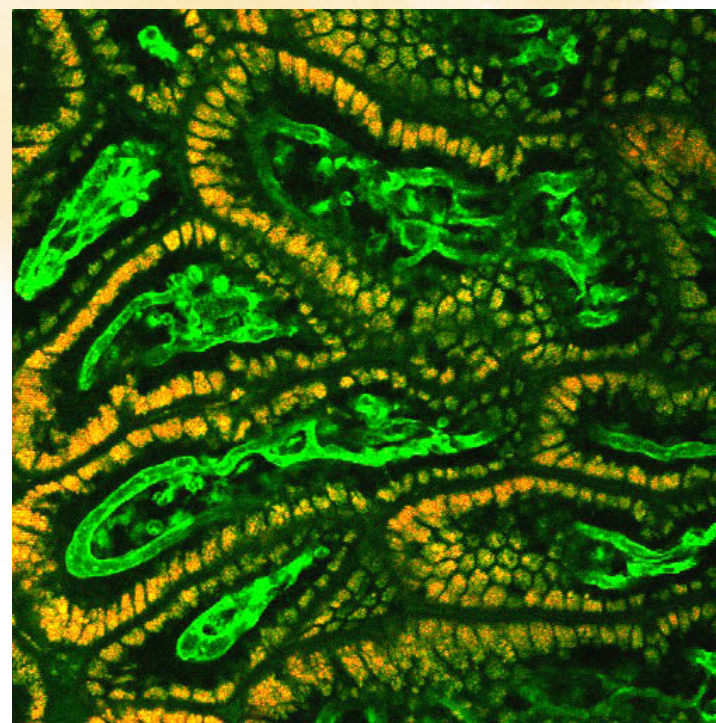
SingHealth Academic Medicine aims to improve patient care by taking an evidence-based, data-considered approach to clinical practice, education and research activities. KKH Paediatric Surgery is part of Surgery ACP while maintaining close collaboration with related ACPs (Paediatrics ACP, Anaesthesia and Perioperative Sciences ACP). With institutional support, the Department has developed in the following academic areas:

## RESEARCH

The seeds of basic science research were planted by Dr Carolyn Tan, recipient of the prestigious British Association of Paediatric Surgeons (BAPS) Prize in 1992 for her research in biliary atresia. At KKH, she established a laboratory for bench research funded by grants from the Singapore Totalisator Board and subsequently, competitive grants from the National Medical Research Council (NMRC). She was one of the pioneers who utilised computer generated three dimensional reconstruction to study the developing foetal biliary system when the technology was still new. Her work laid the groundwork for others to continue lab-based research on competitive grants in later years, albeit in different areas of paediatric surgery, such as surgical oncology (Dr Chui CH and Dr Amos Loh) and neonatal surgery (Dr Chen Yong).

Dr Amos Loh went on to establish the VIVA-KKH Paediatric Brain and Solid Tumour Programme in 2015, a tripartite collaboration between KKH, the VIVA Foundation for Children with Cancer, and world-renowned St Jude Children's Research Hospital. Spearheaded by KKH, this multidisciplinary academic programme focuses on improving outcomes for childhood brain and solid cancers via multidisciplinary clinical care,

translational research and prevention, control and population-based science, with an underlying theme of education, exchange and collaboration with international partners in disciplines related to childhood cancer.



State of art imaging demonstrating intestinal wall microcirculation (blood supply) - used by Dr Chen Yong in research on neonatal gastrointestinal disease.

2009

Low Yee appointed Head of Department

2010

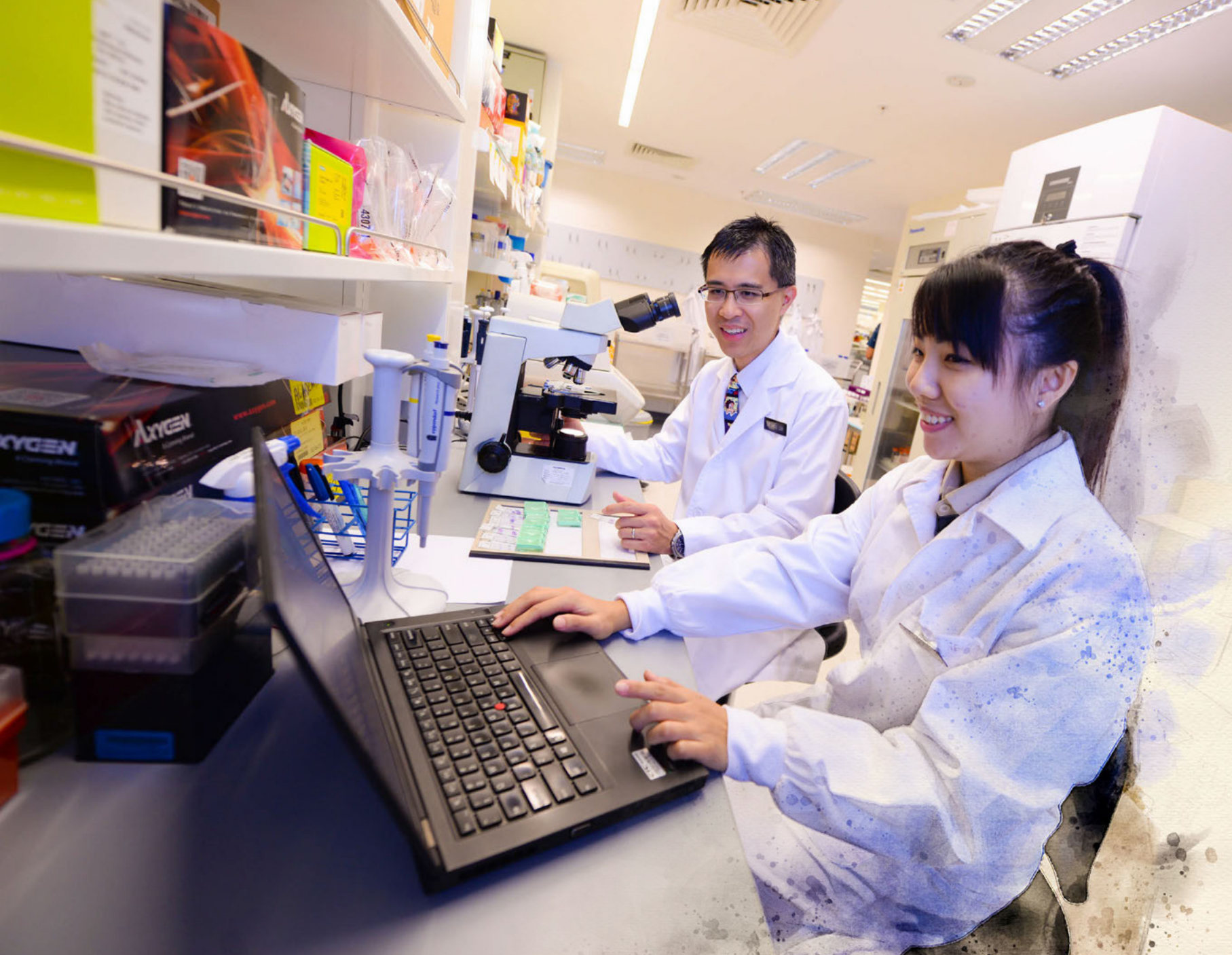
**SingHealth Academic Medicine focus**

The national specialty training system changes, paediatric surgery is included in GS and Urology Residency programmes

2011

Team-based reorganisation of department  
KKH Trauma Registry is set up





Dr Amos Loh in the laboratory with his research staff

2013

Structured international fellowship training programmes in paediatric general surgery, paediatric surgical-oncology and paediatric urology

2015

VIVA-KKH Paediatric Brain and Solid Tumour Programme

2016

Dale Loh appointed Head of Department at NUH

In recent times, the department research output has tripled from 38 peer-reviewed publications from 2000-2010 to 119 from 2011-2020. In the last decade (2011-2020), the total study grant quantum obtained with department staff as Primary Investigators was over \$14 million. Department faculty also mentored a total of 51 students from three medical schools (Yong Loo Lin School of Medicine, Lee Kong Chian School of Medicine, Duke-NUS Medical School), as well as life science students from Nanyang Technological University and Temasek Polytechnic, to complete research projects with conference presentations, resulting in multiple awards and publications.



A/Prof Shireen Nah (in orange) with colleagues (from left) Dr Rambha Rai, Dr Jayne Chiang, Dr Yap Te-Lu and Dr Dale Loh, current Head, Department of Paediatric Surgery NUH, attending the Pacific Association of Paediatric Surgeons Conference in New Zealand in 2019



### Relationships, Research, Right Practice:

**Relationships** – The bonds of friendship I forged with my colleagues (doctors, nurses, students) still hold now. We continue to keep in touch, and often update each other on little personal things – like the weird and funny things our kids say. We are able to collaborate freely on research and other projects, based on the trust built on working in the ‘trenches’ together. **Research** – While I learned the basics of research from my mentor and supervisor in London, it was in Singapore that I was given a huge number of opportunities to put what I learned into practice. Publications, grants, the ethical review process, project management, conference presentations – such an abundance of avenues to hone skills in the research arena. **Right practice** – I was impressed with both the commitment to procedural integrity that I saw at all levels of staff in the hospital, and the ability of the hospital environment and resources to sustain it. I try to bring these principles into my workplace.

#### ASSOCIATE PROFESSOR SHIREEN ANNE NAH,

Head of Department, Paediatric & Neonatal Surgery, Universiti Malaya, on her time in Singapore at KKH Paediatric Surgery

#### 2010

##### SingHealth Academic Medicine focus

The national specialty training system changes, paediatric surgery is included in GS and Urology Residency programmes

#### 2011

##### Team-based reorganisation of department

KKH Trauma Registry is set up

#### 2013

Structured international fellowship training programmes in paediatric general surgery, paediatric surgical-oncology and paediatric urology



## EDUCATION

The department, since its SGH origins, has always strongly supported education with an outsized involvement in medical education. Over the years, many department faculty have received teaching awards, engaged in educational research with publications and hold educational leadership positions at institutional and national level. One of the clinical educators, Dr Caroline Ong, was the first in Singapore to be awarded a Master's in Surgical Education (2015 University of Melbourne/ Royal Australasian College of Surgeons). She worked closely with the Paediatric Surgery Specialist Training Committee (STC)

later renamed Residency Advisory Committee (RAC), together with several departmental heads and training directors to develop national paediatric surgery education and continues to have an active role in other postgraduate education and faculty development in SingHealth.

Since its inception, the department has been intimately involved in Singapore's paediatric surgery specialty training and has trained most of the local paediatric surgeons to date.



A/Prof Caroline Ong receiving the KKH Outstanding Teacher Award in 2014

“

In July 2005 A/Prof Jacobsen was invited by MOH Brunei to help with the operative management of several paediatric patients, give talks and see patients in clinics. As a medical officer contemplating paediatric surgery as a career, I was fortunate enough to be her liaison officer and those few days inspired me to follow in her footsteps. A Memorandum of Understanding between MOH Singapore and MOH Brunei enabled me to do my AST [Advanced Specialist Training] in Paediatric Surgery in KKH... I fondly remember my first ward teaching with Dr Caroline Ong - 'Please examine this baby'. Nervously looking at a fully dressed baby and Dr Ong nodding encouragingly I gingerly undressed the baby only to look up in horror when I found a full nappy. 'Go ahead and clean. If you find it, you need to change the nappy'. Coming from Brunei where there is always a mother or a nurse with the baby who will undress, clean and dress the baby once a doctor finishes examining, I learnt an important lesson that day – a doctor should be able to do a 'nursing job' and to always clean up any mess you find and not leave it to someone else.

### DR JANICE WONG,

Deputy Head of Department, General Surgery, Urology & Paediatric Surgery, RIPAS Hospital, Brunei Darussalam, on her training and career choice

2015  
VIVA-KKH Paediatric Brain and Solid Tumour Programme

2016  
Dale Loh appointed Head of Department at NUH

2018  
Ong Lin Yin appointed Head of Department

The last two decades have also seen regular requests for paediatric surgery fellowship training from the region (see page 75)



I have learnt so many things and after finishing my attachment, we [could] start laparoscopic surgery in Yangon Children Hospital, treating babies with Hirschsprung's disease with new methods, various methods of urethroplasty for hypospadias, etc. Apart from operative skills, I have learnt outpatient care, communication skills, journal appraisal, total parenteral nutrition rounds and basic ultrasound skills. **This training programme is very beneficial for paediatric surgeons from developing countries with limited resources and I hope the department continues training programmes for doctors and nurses from countries like us in the future.**

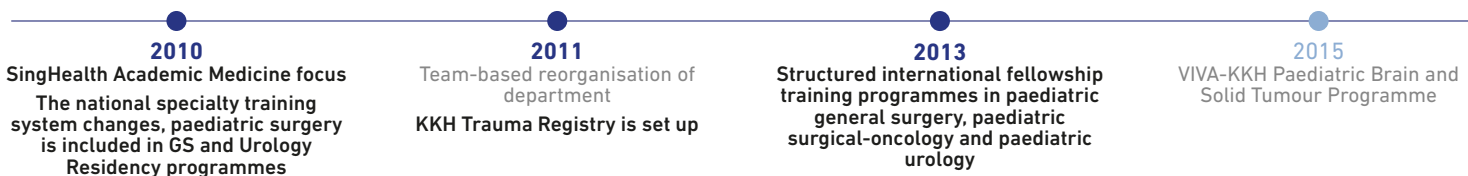
**DR NYO NYO,**

Myanmar paediatric surgeon, on her experience during her attachment in KKH Paediatric Surgery

In addition, the department participates in undergraduate education with all three medical schools (Yong Loo Lin School of Medicine, Lee Kong Chian School of Medicine, Duke-NUS Medical School) as well as postgraduate nursing education. Previously, under the national UK-based specialist training system, the department had limited involvement in training of general surgeons. After Singapore adopted the US-based residency training system in 2010<sup>38</sup>, paediatric surgery became a core component of junior residency training for both the General Surgery and Urology Residency programmes. While this has greatly increased departmental teaching workload, improved access to faculty development has benefited all our learners, as evidenced by highly positive learner feedback scores in undergraduate and postgraduate programmes.

**CLINICAL**

In the early years, the department focused on developing broad surgical expertise and acquiring advanced technology for quality tertiary paediatric surgical care. Having achieved this, the department presently emphasises data-driven and innovative methods to improve patient care outcomes. In the past 20 years, we have undertaken multiple clinical process innovation projects (CPIPs). These have reduced length of hospitalisation stay, reduced operative complications and improved patient experience for many paediatric surgical conditions. Some notable examples are listed in Appendix (page 77). Some larger scale projects involve collaboration with many parties, like the KKH Trauma Registry that was set up in 2011 as part of the National Trauma Registry. Dr Chiang Li Wei, together with the multidisciplinary KKH Trauma team, have utilised the registry to make systemic changes to optimise paediatric trauma care processes<sup>39,40</sup> and drive education for injury prevention.





The department's commitment to continuing quality improvement is shown by the enrolment of KKH Division of Surgery in the American College of Surgeons (ACS) National Quality Improvement Program NSQIP (2020). The ACS NSQIP enables risk-adjusted clinical outcomes to be benchmarked against other internationally renowned children's hospitals for transparency and accountability. Tracking benchmarked outcomes will enhance our clinical improvement audit reviews.

### GLOBAL

Since achieving world-class standards in patient outcomes and training, the department has promoted global health by working with surgeons in low- and middle-income countries in Asia to improve paediatric surgery standards. From 1997-2015, 25 separate regional health capacity development programmes involving paediatric surgical elements were conducted with institutions around the region. Dr Anette Jacobsen took over from Dr VT Joseph as director of the KKH International Medical Programme and grew surgical outreach in the region, leading many surgical missions to Laos, Myanmar, Cambodia, India and Indonesia. She was recognised for her efforts in improving regional paediatric surgery with the Healthcare Humanities Award in 2013. This was also won by Dr Chiang Li Wei in 2019. Dr Jacobsen was instrumental in establishing the KK Regional Outreach to Kids (KKROK) fund in 2002 to aid children requiring advanced care for complex conditions, many of which were surgical in nature. The fund has since helped close to 100 children from Indonesia, Cambodia, China, Myanmar and Malaysia since its inception.

International training fellowship programmes in general paediatric surgery, paediatric urology and paediatric surgical oncology were also established, training 11 regional paediatric surgical fellows from 2013-2019. Other surgeons like Dr Rambha Rai and Dr Low Yee also participated actively in paediatric surgery outreach efforts, particularly in Myanmar and Papua New Guinea. With its strong historical track record in humanitarian surgical outreach, the department combined efforts with other surgical units in SGH and Sengkang Hospital (SKH) to form the SingHealth Duke-NUS Global Surgery Programme in 2018, with Dr Amos Loh as the founding programme chair. This structured initiative seeks to address gaps in surgical care capabilities in the region through education, capacity building and research.

**2016**  
Dale Loh appointed Head of Department  
at NUH

**2018**  
Ong Lin Yin appointed Head of Department

**2020**  
150th case of paediatric liver transplant  
at NUH  
Enrolment in ACS NSQIP



Dr Sai Woon MT, while working at KKH, and at his private clinic on his return to Myanmar



Dr Huma (seated, centre), in a picture taken with the department at her farewell



My time in the department helped me gain more confidence in managing paediatric surgical cases, as well as developing critical thinking in clinical research. I went on to write and successfully publish a clinical research paper. Currently, I am working at my own private medical clinic at Tachileik, Myanmar. I have carried over technological know-how and patient care/surgical skills which I learned from my time in KK Hospital, such as: Taking more time to talk and discuss with patients on their issue which is not common in Myanmar. I came to realise the doctor-patient relationship can be improved only by giving more time to talking with patients.

#### DR SAI WOON MT,

Myanmar doctor, on his time in Singapore at KKH Paediatric Surgery



The first time I was asked to operate, I was a bit anxious, but my supervisor Dr Amos gave me confidence and trust to operate on major tumors with confidence and take me through operating in highly technical situations without compromising patient safety. The neuroblastomas and the hepatomas - something new to be learned every day! I also had a chance to be involved in research activities that included international indexed journal publications and an award-winning paper presentation. The fellowship has allowed me to acquire state of the art, advanced oncology surgical skills along with general paediatric surgery skills... This well-designed programme is an excellent programme for anyone willing to learn onco-surgery. Throughout the training, I have been exposed to both surgical and non-surgical complex situations under supervision.

#### DR HUMA,

Pakistani paediatric surgeon, on her fellowship training in Singapore at KKH

2013

Structured international fellowship training programmes in paediatric general surgery, paediatric surgical-oncology and paediatric urology

2015

VIVA-KKH Paediatric Brain and Solid Tumour Programme

2016

Dale Loh appointed Head of Department at NUH





A/Prof Anette Jacobsen, A/Prof Low Yee and Dr Rambha Rai on various surgical mission trips in the region

2018

Ong Lin Yin appointed Head of Department

2020

150th case of paediatric liver transplant  
at NUH  
Enrolment in ACS NSQIP

2021

Paediatric Surgery celebrates its  
40th anniversary



# Our Patients' Voices

**Forty years later...with tens of thousands of children treated... there are so many stories to tell. Here are just four patient stories that show the impact of paediatric surgery on their life trajectories.**

## The Quadruplets: World Record Holders

Meet the teenage quadruplets Yannis, Shana, Abby and Zacharee, whose remarkable debuts earned them an entry into the Guinness Book of World Records! The oldest, Yannis, arrived on 14 September 2004. He was very premature at 26 weeks gestation, weighing only 800g. His three sisters managed to hold on longer and made their grand entrance into the world on 23 September, that is, **9 days, 1 hour and 53 minutes** later! They hold the record for the longest interval between birth of quadruplets.

Ms Seah Siew Hwee and her husband were in the KKH In Vitro Fertilisation (IVF) programme. Both had prayed separately for twins and their prayers were well and truly answered! Multiple pregnancies (when a mother carries two or more babies) is known to be associated with prematurity and other health issues, and the quadruplets were not exempt. Yannis and Shana faced many serious health challenges in the early months of their lives. Their paediatric surgeon was Dr Low Yee.

### YANNIS

Yannis had necrotising enterocolitis. This is a serious condition affecting premature babies, where severe inflammation of intestines may result in gangrene of the intestinal tissue, and in serious cases, cause the death of the baby. Yannis also had chronic lung disease, brain hemorrhage (both common

conditions in premature babies) and needed fundoplication (an operation on the stomach) and a tracheostomy (when an opening is created in the windpipe). Mum Siew Hwee recalls, "There were just too many Code Blue activations that we lost count." (The Code Blue rapid response team is a group of doctors and nurses expert in resuscitation, who are activated for collapsing patients). Yannis was a fighter, a survivor! He was finally united with his sisters after spending 179 days in the neonatal intensive care unit (NICU).

In 2020, Yannis passed the GCE 'N' levels. He attained the Chief Commissioner's Award which is one of the highest awards in Scouting and was awarded the Ngee Ann Secondary School's CCA Excellence Award recognising his scouting achievements.

### SHANA

Shana had her share of health issues. Just a week after birth, she developed a bloated abdomen. Investigations showed she had an abscess near her liver. She needed surgery, and in her frail condition, her parents were told she only had a 50% chance of survival. But survive she did! Altogether, she spent 81 days in the NICU.

And now, Shana has graduated from Singapore Chinese Girls' School's Integrated Programme and is currently pursuing her dream in Eunoia Junior College!



OUR PATIENTS' VOICES



Yanniss: 26 weeks, 800g



Abby: 27 weeks, 920g



Shana: 27 weeks, 940g



Zacharee: 27 weeks, 970g



And the quadruplets today...



## The Survivor

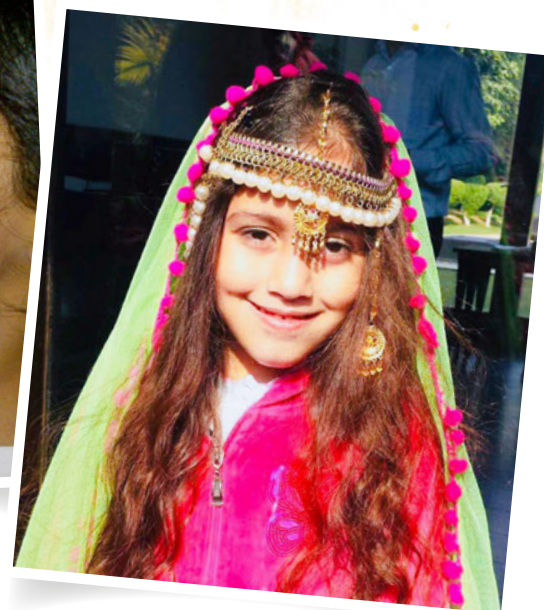
Like Yannis, Ayana Bedi had necrotising enterocolitis in July 2011. Without surgical intervention, the outlook was grim. She was at risk of sepsis and death from a perforation in her intestines. In desperation, her family flew her from India to Singapore for treatment, hoping against hope for a cure.

Her parents recounted, "We remember our Ayana being very sick. Her liver was not functioning. She didn't look human when we got her to KKH! Dr Anette Jacobsen restructured her entire gastrointestinal system and fish oils/lipids helped her liver revive."

Ten years later, Ayana is now a thriving, fiery and feisty tween!



Baby Ayana with mum... and Ayana today!



## Gunning for glory

**Para-athletes ready to do Republic proud next month, after a long preparation**

Report by JESSIE SOH  
joh@nph.com.sg

**He struck gold in the 800m at the 2011 Special Olympics World Summer Games in Greece.**

While that victory ranked as one of the highlights of his athletics career, making the podium at next month's Asian Para Games in Singapore will be extra special for Subash Subash. After all, this is the first time the 18-year-old student with intellectual disability will be competing at home and he hopes the support from his countrymen can spur him to glory. He will be competing in two events – the 400m and the long jump in the T20 category for athletes with intellectual disability. Athletics is one of 15 sports which will be contested from Dec 3-9.



**THUSHELS UP**

(From left) Team Singapore para-athletes Lim Wei Leong, Subash Subash, Marc Chiang, Neelish Red, and (right) Lee Yuan Ping, with HCCY Senior Minister of State Sim Ann (second from right) yesterday.

PHOTO COURTESY OF SINGAPORE OLYMPIC COMMITTEE

PHOTO COURTESY OF SINGAPORE OLYMPIC COMMITTEE

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PHOTO COURTESY OF SINGAPORE OLYMPIC COMMITTEE

focus on his passion – athletics.

Despite having to juggle both his studies and training five days a week, he has set his sights on bettering his personal best of 56 seconds in the long 400m and 6.5 metres in the long jump.

And after finishing outside the podium at the last Asian Para Games, he is more determined to make the podium this time round.

"I saw how the athletes from other countries ran, and I realised that they were more talented than me. So when I came back to Singapore, I asked my coach to train me more," he said.

"The Malaysians will be my main

rivals, but I'll just focus on what my coach taught me – the techniques and the movement. Hopefully, I'll get to win a medal. The colour of the medal doesn't matter."

Subash was one of five para-athletes who attended yesterday's Sports Without Borders Roadshow at Pasir Ris Sports Centre, where members of the public tried some of the sports at next month's Games, including goalball and bocce.

Sim Ann, Senior Minister of State for Ministry of Culture, Community and Youth, mingled with the athletes and took part in modified table tennis and bowling at the roadshow.

### CONFIDENCE

"I know that a lot of effort has been put into the preparations and I have every confidence in our team," she said.

"I think we will do a very good job at hosting the Games and I am also very confident that our Team Singapore athletes will do us all proud."

Marc Chiang, captain of Singapore's first goalball team at the Games, is taking the pressure in his stride.

"We may be new to the sport, but we have been training hard on our strategies," he said. "We are very confident that we will deliver."

## The Paralympian

Ms Lee Yuan Ping was born with spina bifida, a condition whereby the spinal cord did not form properly, causing weakness of both her lower limbs as well as bladder and bowel problems. She is wheelchair-bound and was a frequent visitor to the hospital in her childhood. She underwent a major operation by Dr Anette Jacobsen in 2002 to increase the size of her bladder for kidney protection and social continence. This major episode required her to stay at KKH for two months. She recalls, "I was in tears when wheeled into the operating theatre... but now, I can catheterise myself easily and no longer feel constipated like I did before!"

Ms Lee Yuan Ping (extreme right) featured in the press when she represented Singapore in the 2015 Paralympics

Source: [The New Paper] © Singapore Press Holdings Limited. Permission required for reproduction.

In 2015, Yuan Ping donned Singapore colours to represent her country in the Paralympics. What a tale of inner strength and resilience!



## The Patient Turned Doctor

One-year-old Guo Yuan was diagnosed with pelvi-ureteric junction obstruction in 1993. This is a congenital abnormality involving the urinary system, causing outflow obstruction of the affected kidney. Untreated, it may cause progressive deterioration in kidney function. Patients who have this condition require regular monitoring scans and sometimes, surgery. For Guo Yuan, his problem was resolved after undergoing surgery by Dr Yap Te-Lu.

Almost two decades later, not only is Guo Yuan living a healthy life, he has become a qualified doctor! As a medical student, he returned to the department to conduct clinical research under the guidance of his former surgeon Dr Yap. In 2019, after his graduation, he again chose to return to the department as a medical officer.



Guo Yuan (extreme right) as a medical student attending the Asian Association of Paediatric Surgeons Conference in Seoul in 2012 with paediatric surgeons Dr Cheong Yee Ling (extreme left), Dr Fay Li (second from left) and other medical officers from the department



Even though I underwent surgery as a very young child and do not have clear memories surrounding that exact surgery, the years after my surgery have been worrying at times for my family and me. Besides the need for regular intravenous injections for the various scans, something which I definitely did not look forward to as a young child, there have been occasions whereby doctors were concerned about my kidney function being affected post-operatively and the possible need for repeat surgery. My family and I are very grateful to the doctors from the Department of Paediatric Surgery at KKH who were supportive and encouraged us throughout this entire journey.

The doctors in the department have quite literally been a part of my life since I was born. Having been a patient, a student and a doctor in the department, it has been a true privilege to be healed by and learn from some of the best doctors and mentors I have met in my life.

DR HOW GUO YUAN

# In Their Own Words – Paediatric Surgeons & Trainees



*Paediatric Surgery is the BEST specialty to choose – the only specialty where you can take a newborn from sure death to 80 years of normal life.*

**Associate Professor Anette Jacobsen**

Former Head, Department of Paediatric Surgery, KKH

**Let us hear the voices of the paediatric surgeons, trainees and their colleagues. Let us see the human faces behind the surgical masks; understand why they chose this specialty and what their hopes are for the future.**

## Unique Specialty



Paediatric surgical cases are always varied, but few would bear significant similarity. There is great breadth and depth. I was impressed by the congenital anomalies, oncological tumours, and acute paediatric surgeries that made the paediatric surgeon a “true general surgeon”.

**DR CHUI CHAN HON,**

Former Head, Department of Paediatric Surgery, KKH; currently in private practice



Dr Chui Chan Hon addressing the audience at a local conference





As a young trainee, I chose paediatric surgery because it married two loves - children and surgery. It was only on embarking on the journey that I realised how challenging it was – in so many aspects. The breadth of conditions made one sometimes feel like one never got off the learning curve! The variability – every child a different age and weight – meant every treatment order had to be tailored. Tissue was more delicate to handle, operative spaces were tiny for minimally invasive work... the demand on the surgeon is turned up quite a few notches when working with children and babies! But the work is so rewarding. It is marvellous to see a young child with a serious condition overcome his health issue and grow up healthy and happy!

**ASSOCIATE PROFESSOR LOW YEE,**

Senior Consultant, former Head,  
Department of Paediatric Surgery, KKH



As paediatric surgeons, we help children to whom nature has delivered an inferior deal in life. We are one of the few specialties who follow our patients from the time they are born, through their childhood milestones, until they become independent adults, with their own dreams and ambitions. We are like their second family, sharing their successes, failures, trials and triumphs. We witness their resilience, tenacity and ability to remain happy in possibly the worst of circumstances. Through our journey with them, they give us hope: that we will develop better surgical techniques for improved functional outcomes; that we will innovate and find new technologies to improve their quality of life; and that we have managed to help raise a child, who will someday make a difference in the life of another.

**DR ONG LIN YIN,**

Current Head, Department of Paediatric Surgery, KKH



I chose to work in paediatric surgery because I found it interesting and rewarding. I don't view it as a job but I believe it is my calling and my destiny to be in this department. I always wanted to care for children because they capture my heart. Most of them are healthy but they have unique problems that require special surgical management. They can be very sick but after surgical correction most of these children can live normal and productive lives. Children are not just small adults. They are unique individuals that need to be cared for. It's my happiness and fulfilment to see our patients go home to their parents after successful treatment.

**DR DORIS DIMATATAC,**

Principal Resident Physician, Department of Paediatric Surgery, KKH

## Sometimes the Specialty Chooses Us

“

As the only female surgical trainee, my rotation through NUH General Surgery meant I did more paediatric surgical work than the men. It was just the way it was then. I realised that I could manage the children and parents quite well. Unlike the other surgical trainees, I enjoyed paediatric surgery although I was quite often awed and dwarfed by the many unexplainables.

**DR JOYCE CHUA,**

Paediatric surgeon, currently in private practice

“

In medical school I wanted to become a paediatrician but didn't get the posting as a houseman. Thereafter, I fell in love with surgery but found surgery for adults “very boy's club” as a basic surgical training (BST) trainee. In contrast, I felt very welcomed as a BST trainee during my paediatric surgery rotation, so I applied for paediatric surgery advanced surgical training (AST).

**ASSOCIATE PROFESSOR CAROLINE ONG,**

Senior Consultant, Department of Paediatric Surgery, KKH



Dr Joyce Chua, Dr Janice Wong and Dr Jason Barco at a laparoscopic workshop in 2007

“

Paediatric surgical oncology was a late discovery for me. I was already a trainee at a local hospital when I stumbled on it. It was an unpopular field with an abyss of undiscovered knowledge and unanswered questions. I was always eager to apply my work as a doctor and researcher where needs from patients were the greatest, so I jumped right in.

**DR AMOS LOH,**

Senior Consultant, Department of Paediatric Surgery, KKH



## Little Ones Bring Joy



One of my most challenging patients is a patient who was born with long gap esophageal atresia. She is also one of my dearest patients. To date, she has undergone four major operations and multiple minor procedures. I am lucky to encounter her parents who are very understanding. We have supported one another during the course of her treatment and have gone through rough times together. I am glad to announce that she is eating on her own and is growing up “normally”. This has made all the hard work and stressful moments during the course of caring for her worth it!

**DR SIM SIAM WEE,**

Consultant, Department of Paediatric Surgery, KKH



Paediatric surgery allows me to combine two of my passions - surgery, which allows me to use my hands to perform procedures to heal, and children. I love the way surgery can help a child recover quickly from a dangerous acute condition and the fact that I get to play with babies and kids as part of my job!

**DR ESTHER CHAN,**

Paediatric surgery resident



At Santa Run for charity: A/Prof Low Yee (extreme left), Dr Lee York Tien (centre), Dr Esther Chan (extreme right), together with several medical officers



A good paediatric surgeon loves children, but the best paediatric surgeon makes children love him or her.

**DR CHIANG LI WEI,**

Senior Consultant, Department of Paediatric Surgery, KKH



Paediatric surgeons with medical officers, surgical residents, administrative and research staff

## Healing Children is So Rewarding

“.....

The most beautiful thing about being a paediatric surgeon is that you will never know if the baby or child you had just saved may grow up to be the next prime minister or the next Albert Einstein – you are not only saving their lives, you are giving them a lifetime of endless possibilities.

**DR LEE YORK TIEN,**

Consultant, Department of Paediatric Surgery, KKH

“.....

Paediatric surgical patients get cured and live for another 70-80 years, unlike older patients.

**ASSOCIATE PROFESSOR NARASIMHAN KL,**

Senior Consultant, Department of Paediatric Surgery, KKH

“.....

During my postgraduate rotation, I realised that paediatric surgery is one of the most difficult branches of surgery. At the same time, it's most gratifying to see the results of one's efforts when children recover and grow up well... I feel good, happy and positive working with kids as they are innocent, simple and energetic. It is a great pleasure to see them recover from their surgeries.

**DR RAMBHA RAI,**

Senior Consultant, Department of Paediatric Surgery, KKH



## Moments That are Their Own Reward



One of my patient's mother requested for me to become godmother for the baby, after quite a long stay in the High Dependency ward. I was really touched, and I gladly agreed.

**DR PREETHI JOSEPH,**

Resident Physician, Department of Paediatric Surgery, KKH



My favourite thing is when patients get better and go home, I get to give them a high-five for their bravery or a hug for comfort and gratitude... One of my fondest memories was when I got a handmade flower brooch from one of the long-stay patients. I saw her almost every day during her hospitalisation and we bonded over our shared love for art and craft. It was a very sweet gesture and remains one of my favourite momentos from the job.

**DR MEGHAN LIM,**

Paediatric surgery resident



With a dinosaur in the paediatric surgery ward: Dr Jayne Chiang and Dr Lee York Tien (from left to right)



Painting colourful murals on the walls of the operating theatre to make the atmosphere more welcoming for children

## Poignant Memories



I really enjoy running my chronic case clinic as it is such a privilege to see the patients grow up and develop - like a tiny 600g premature baby who later becomes a strapping teenager in secondary school... There are also horrid memories, like crying in the operating theatre as a young consultant the first time my patient died on-table (a sick premature neonate with uncorrectable liver bleeding). Other deaths also hit hard, such as a brave long-term patient who died from incurable congenital intestinal failure at age 10 years old – the same age as my youngest child then.

**ASSOCIATE PROFESSOR CAROLINE ONG,**  
Senior Consultant, Department of Paediatric Surgery, KKH



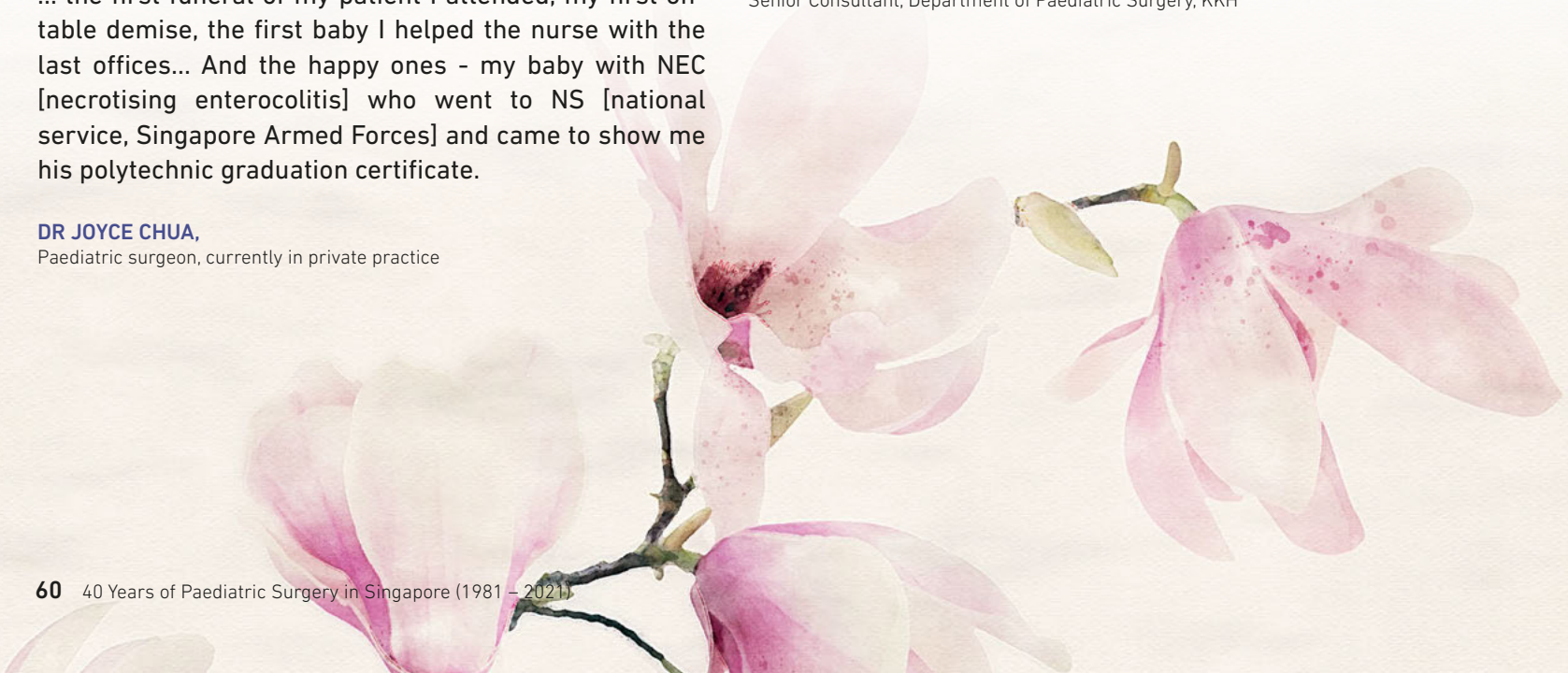
... the first funeral of my patient I attended, my first on-table demise, the first baby I helped the nurse with the last offices... And the happy ones - my baby with NEC [necrotising enterocolitis] who went to NS [national service, Singapore Armed Forces] and came to show me his polytechnic graduation certificate.

**DR JOYCE CHUA,**  
Paediatric surgeon, currently in private practice



I can vividly remember this boy who had a relapsed Stage 4 high risk neuroblastoma - a cancer of the nerve cells. He came to have a tumour in his belly removed, which had grown back aggressively despite treatment. Surgery was difficult and prolonged. Due to complications, his stay in the hospital was prolonged into the Christmas season. Despite his pain, he always had a smile for everyone. His chances of surviving the relapse were slim...I finally plucked up the courage and bought him a small toy, and sheepishly handed it to him when I was next on duty, which turned out to be Christmas Eve. I will never forget the look on his face when he woke on Christmas morning to open the gift and immediately play with it! He passed away not long after that. He is one of those who left a strong impression on me, making me determined to make a difference.

**DR AMOS LOH,**  
Senior Consultant, Department of Paediatric Surgery, KKH





## The Challenges of the Craft



Dr Yap Te-Lu and Dr Chen Yong at work in the operating theatre

“.....

Some parents can be very demanding and some of them are very certain that they know more about medicine than we do. Sometimes it's so difficult to let them understand, especially when they are very stressed with the condition of their child. I always try to gain their trust in order for them to believe in us.

**DR DORIS DIMATATAC,**

Principal Resident Physician, Department of Paediatric Surgery, KKH

“.....

Nothing and no one can prepare you to bear witness to faultless babies and children being afflicted with illness and suffering, and sometimes even death. Over time I have learnt to stop asking why, and to accept that certain things are beyond our ability to control or even change. However, I have also learnt to recognise the role that paediatric surgeons play in their patients' surgical journey - we can restore abnormal anatomy through precision surgery, alleviate symptoms and improve quality of life, and provide support and encouragement to parents when it's all too much for them to bear. So despite the heartache, this is why we do what we do.

**DR FAY LI,**

Consultant, Department of Paediatric Surgery, KKH

“.....

The biggest challenge I can recall was the time when I had to balance training needs with my role as a mother of two young kids. This was in 2007 when I started my AST [advanced specialist training] and my children were 6 and 3 respectively. Luckily, things fell in place, and everything was settled happily. Much credit also goes to my colleagues who made it possible.

**DR RAMBHA RAI,**

Senior Consultant, Department of Paediatric Surgery, KKH

## Great Colleagues and Work Culture



Working and treating people with various nationalities, cultures and religions. Specifically, I will remember the 'makan-makan' moments with all the consultants, colleagues, administrative and clinic staff. Apart from a better understanding of paediatric surgical oncology, I have explored a better perspective on minimal access surgery in children and gained more interest in conducting research and publication. Thanks for letting me be part of the KKH's Paediatric Surgery family!

**DR MOHD YUSRAN BIN OTHMAN,**

Malaysian paediatric surgeon on his fellowship with KKH Paediatric Surgery



Dr Mohd Yusran (back) with his mentor in paediatric surgical oncology, Dr Amos Loh



Nothing has been more inspiring or memorable to me than to witness medical professionals from across Singapore come together during the trying times of COVID-19. I have learned to be more open minded, to think of other solutions, to help make laparoscopy as one of the acceptable approaches to most, if not all surgeries, in our department. Thank you, for the training, for all the teaching, for the beautiful memories and the absolutely lovely time I have spent there. I am grateful for being treated like family.

**DR HANA ARBAB,**

Pakistani paediatric surgeon on her fellowship with KKH Paediatric Surgery





Dr Hana Arbab with members of the KKH paediatric surgery "family"

(Back row from left to right): Dr Hana Arbab, Dr Lee York Tien, Dr Chen Yong, Dr Sim Siam Wee, Dr Chiang Li Wei, Dr Amos Loh, A/Prof Narasimhan  
(Front row from left to right), Dr Doris Dimatatac, Dr Rambha Rai, Dr Amanda Chng, Dr Ong Lin Yin, A/Prof Caroline Ong



Dr Preethi Joseph at the paediatric surgery outpatient clinic, KKH

“.....

I like everything about my department. The systematic way in which the department works, the meetings, the transparency, the teamwork, and in the midst of heavy duties and workload, the fun we have.

**DR PREETHI JOSEPH,**

Resident Physician, Department of Paediatric Surgery, KKH

## Our Hopes for the Future

### BLESSING THE REGION AND THE WORLD

“.....

A centralised training programme in paediatric surgery for South-East Asia should be formulated with the aim to uplift the standard of surgical care in children. We should share our blessings with our neighbouring countries.

**DR CHUI CHAN HON,**

Former Head, Department of Paediatric Surgery, KKH; currently in private practice

“.....

I would like to wish the Department of Paediatric Surgery long-lasting success as one of the most advanced and reliable centres for the care of the children, and for training the top paediatric surgeons in the region and internationally

**DR NYO NYO,**

Myanmar paediatric surgeon, former attachment in KKH Paediatric Surgery



## INNOVATION, TECHNICAL ADVANCEMENTS AND RESEARCH



I would like to see more innovation in the field of paediatric surgery. While many medications and devices have been developed for adults, there is often a lack of suitable alternatives for children. My other hope is to see an expansion in research in the field of paediatric surgery so that we may improve patient care.

**DR MEGHAN LIM,**  
Paediatric surgery resident



I hope to see surgeons gaining more knowledge, being more passionate with their work, being ethical and practicing evidence-based medicine. I wish to see the progress in less invasive to non-invasive procedures to treat ailments in children.

**DR SAI PRASAD TR,**  
Paediatric surgeon in Bangalore, India, former fellow at KKH Paediatric Surgery



Wish for all the residents and Consultants to have a good career and good international friendship. I hope that the Department of Paediatric Surgery, KKH shines as the beacon for Asia and leads in innovation and training.

**DR THICHEN LAMA,**  
Paediatric surgeon in private practice in New Delhi, India, former fellow at KKH Paediatric Surgery



Science and technology has constantly advanced because of the better understanding of the laws of nature. In our own lifetime, the science and art of clinical diagnosis as well as the management of surgical patients has evolved. In the future, I hope to see earlier diagnosis of foetal anomalies using more sophisticated imaging, with treatment being refined by Artificial Intelligence, assisted minimally invasive devices and tissue engineering.

**ASSOCIATE PROFESSOR NARASIMHAN KL,**  
Senior Consultant, Department of Paediatric Surgery, KKH





Dr Ong Lin Yin, with Dr Chiang Li Wei, using intra-operative ultrasonography to guide an operation





Dr Sim Siam Wee and Dr Fay Li using intra-operative X-Ray imaging to guide operative procedures (above) – a far cry from how operating theatres looked like previously (left)

## IMPROVING QUALITY OF LIVES



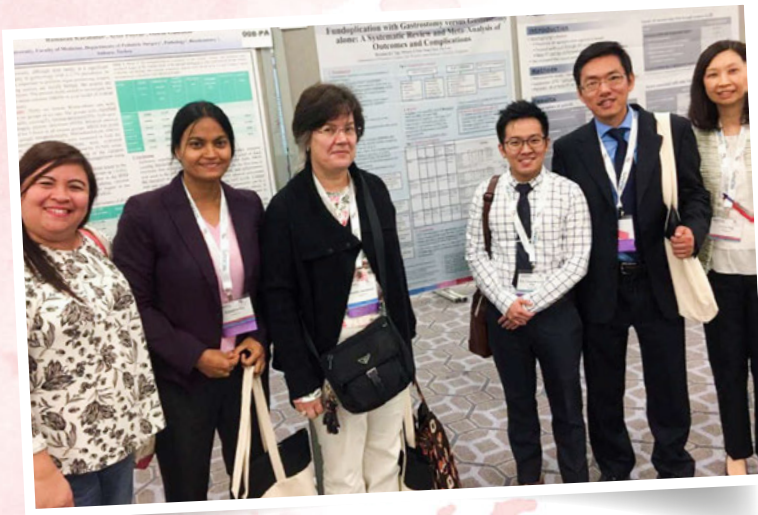
As healthcare continues to improve, there will likely be an increasing number of children surviving even rare and/or more severe congenital conditions, and it would be good to hone our understanding of these conditions and their management, so as to see our young patients transit seamlessly into adult care as they grow up.

**DR JAYNE CHIANG,**  
Paediatric surgery resident



To the paediatric surgeons of the future, you have been given a unique opportunity to make a difference in the life of a child and their family. It will be a challenging and emotional journey but it will be well worth the effort you put into it. In this specialty, training, learning and development never ends. There is always an area to improve on, a new goal to reach for. Never rest on your laurels or be content with what you have achieved. Continue to tread new paths, think outside the box, explore new frontiers and give our children a future to call their own.

**DR ONG LIN YIN,**  
Current Head, Department of Paediatric Surgery, KKH



Presenting departmental research at a surgical conference:  
(From left to right) Dr Doris Dimatatac, Dr Rambha Rai, A/Prof Anette Jacobsen, Dr Brendan Yap (medical officer), Dr Chen Yong, Dr Yap Te-Lu



I hope the specialty at large will continue to innovate, not just to save lives but to continuously improve the quality of lives of children who need surgery. And my hope for the Department of Paediatric Surgery at KKH is that it will continue not just to uphold excellence in clinical care and academic pursuits, but also continue to build and grow a team of surgeons rooted in integrity, compassion for their patients and passion for their work!

**ASSOCIATE PROFESSOR LOW YEE,**  
Senior Consultant, former Head, Department of Paediatric Surgery, KKH





*A society grows great when the old plant trees,  
whose shade they know they shall never sit in.*

**Greek proverb**

And so the story of paediatric surgery has unfolded, from its uncertain beginnings more than a century ago in Europe, to its present maturity of 40 years in Singapore. We honour the vision, passion and daring-do of our pioneers that made it possible.

As we look forward to the next 40 years, research and education promise new technologies, better training and understanding. We embrace this future of improved care for children with surgical conditions, not just in Singapore, but also globally.

Always, we remain guided by our patients' voices; they represent the heart of all we do, and the reason for our specialty's existence.





## In Pictures – Paediatric Surgeons & Trainees

Spending time together on social activities, both during and outside work, has forged strong bonds in the KKH paediatric surgery “family”



A/Prof Anette Jacobsen leading a troupe of dancers at KKH dinner and dance 2018. With her are A/Prof Low Yee (5th from right), Dr Rambha Rai (3rd from right), Dr Sai Woon MT (extreme right)



Dressing up to perform a dance in celebration of Nurses' Day 2013; Dr Fay Li (centre) and Dr Rambha Rai (extreme right)



Travelling together with administrative staff from the Division of Surgery, KKH. (Left to right) Dr Ong Han Lim, A/Prof Narasimhan, Dr Jason Barco, Dr Doris Dimatatac, Dr Fay Li, Dr Rambha Rai





Celebrating important milestones together: Paediatric surgeons at A/Prof Narasimhan's daughter's wedding in Chennai, India (pictured here with the bride and groom, from left to right): Dr Fay Li, A/Prof Anette Jacobsen, A/Prof Narasimshan, Dr Rambha Rai, Dr Cheong Yee Ling



Eating together is an important means of departmental bonding... in small groups or big (pre-pandemic), whether welcoming a new member, saying farewell, or just celebrating the end of a long week.





All photos from left to right:

Top left photo: Dr Chiang Li Wei, Dr Preethi Joseph, A/Prof Low Yee, Dr Chen Yong, Dr Doris Dimatatac

Top right photo: Paediatric surgery residents Dr Jayne Chiang, Dr Esther Chan (with baby), Dr Meghan Lim, Dr Toh Qi, Dr Lee Yang Yang (NUH)

Middle photo: Dr Yap Te-Lu, Dr Lee York Tien, A/Prof Anette Jacobsen, Dr Rambha Rai, Dr Amos Loh

Bottom left photo: APN Lok Hui Lu, Dr Fay Li, Dr Sim Siam Wee, APN Joanne Liam, A/Prof Caroline Ong

Bottom right photo: Seated: Dr Ong Lin Yin, Dr Cheong Yee Ling; Standing: Dr Lin Yea Chyi, A/Prof Narasimhan, Dr Ong Han Lim

(APN: Advanced Practice Nurse)





The Department of Paediatric Surgery, KK Women's and Children's Hospital 2021

1st Row (L-R): A/Prof Low Yee, Dr Yap Te-Lu, A/Prof Narasimhan KL, A/Prof Anette Jacobsen, A/Prof Caroline Ong, Dr Ong Lin Yin (HOD), Dr Amos Loh

2nd Row (L-R): Dr Cheong Yee Ling, Dr Chen Yong, Dr Sim Siam Wee, Dr Rambha Rai, Dr Fay Li, Dr Chiang Li Wei

3rd Row (L-R): Dr Preethi Joseph, Dr Ong Han Lim, Dr Lee York Tien, Dr Lin Yea-Chyi, Dr Doris Dimatatac

# People

## Local Paediatric Surgeons

At present (in 2021), there are 25 paediatric surgeons registered under the Specialist Accreditation Board (SAB) in Singapore, of whom 19 trained in SGH/KKH, four trained in NUH and two trained overseas. Of the 25 local paediatric surgeons, there are 18 in the public sector (14 KKH/4 NUH) and seven in the private sector.

Completed training	Specialist paediatric surgeons in Singapore
1970s	VT Joseph, Chua Wan Hoi
1980s	Sim Chiang Khi, Cheah Siew Leng, Ong Nai Theow, Prabhakaran S/O Krishnan
1990s	Carolyn Tan Eng Looi, Grace Tan Hwee Neo, Anette Sundfor Jacobsen, Narasimhan Kannan Laksmi, Yap Te-Lu
2000s	Chui Chan Hon, Dale Loh Ser Kheng, Low Yee, Caroline Ong Choo Phaik, Vidyadhar Padmakar Mali, Joyce Chua Horng Yiing, Ong Lin Yin
2010s	Chiang Li Wei, Amos Loh Hong Pheng, Rambha Rai, Sim Siam Wee, Nyo Yoke Lin, Cheong Yee Ling, Lee York Tien, Li Xiangzhen Fay, Ong Han Lim, Jasm Nidhu, Wong Zeng Hao

## Leaders in Paediatric Surgery

Head of Department	SGH / KKH	Division of Surgery KKH
VT Joseph	1981-1997	Chair 1999-2002
Carolyn Tan	1997-1999	Chair 2003-2005
Anette Jacobsen	1999-2005	Chair 2005-2012
Chui Chan Hon	2006-2008	–
Low Yee	2009-2017	Deputy Chair 2013-current
Ong Lin Yin	2018-current	–
Amos Loh	–	Deputy Chair 2021-current

Chair, Chapter of Paediatric Surgeons, College of Surgeons, Academy of Medicine Singapore	
Anette Jacobsen	2005-2009
Chui Chan Hon	2009-2013
Caroline Ong	2013-2015
Anette Jacobsen	2015-2017
Dale Loh	2017-2021
Amos Loh	2021-2023



**Chair, MOH Specialist Training Committee (STC)/ Residency Advisory Committee (RAC)**

Prabhakaran S/O Krishnan	Start to 2018
Low Yee	2019 to current

**Close Association with Paediatric Surgery**

Over the years, there have been many foreign-trained paediatric surgeons, fellows and staff doctors who have worked in Paediatric Surgery in SGH and/or KKH. Some chose to make Singapore their home after spending several years with the department.

**Foreign-trained Paediatric Surgeons**

SGH Years	Tan Hock Lim (Malaysia, UK and Australia), Ohn Maung Maung (Myanmar), Muhammad Afzal Sheikh (Pakistan)
KKH years	Ramnath Subramaniam (UK), Thichen Lama (India), Sai Prasad (India), Samir Gupta (India), Kabirul (Pakistan) , Shireen Anne Nah (Malaysia)

**Resident and Staff Physicians**

SGH years	Pe Nyun (Myanmar), Gonca Topuzlu Tekant (Turkey)
KKH years	Jason Barco (Philippines), Chen Yong (China), Doris Mae Abear Dimatatac (Philippines), Preethi Joseph (India), Lin Yea-Chyi (Germany), Amanda Chng (Malaysia)

**Formal Training Programme**

Janice Wong (Brunei), Jack Mulu (Papua New Guinea), Nyo Nyo Win (Myanmar), Maung Maung Lwin (Myanmar), Kyaw Hsan (Myanmar), Phyo Mar (Myanmar), Huma Faiz (Pakistan), Mohd Yusran Bin Othman (Malaysia), Hana Arbab (Pakistan)

## Awards

### International

1992	Carolyn Tan	British Association of Paediatric Surgeons (BAPS) Prize
2000	Low Yee	34th Singapore-Malaysia Congress Young Investigator Award
2001		Australasian Association of Paediatric Surgeons (Best Registrar Paper)
2009	Amos Loh	42nd Annual Congress of International Society of Pediatric Oncology (SIOP) International Society of Pediatric Surgical Oncology (Best Paper)
2015	Lee York Tien	47th Annual Congress of International Society of Pediatric Oncology (SIOP) International Society of Pediatric Surgical Oncology (Best Paper)
2018	Esther Chan	20th Annual Congress of Asia Pacific Association of Paediatric Urologists (Best e-Poster)

### National

2008	Ong Lin Yin	College of Surgeons Gold Medal in Paediatric Surgery, Academy of Medicine Singapore
2011	Amos Loh	College of Surgeons Gold Medal in Paediatric Surgery, Academy of Medicine Singapore
2013	Anette Jacobsen	Healthcare Humanity Award
2019	Chiang Li Wei	Healthcare Humanity Award

### Cluster

2013	Amos Loh	SingHealth Publish! Award (Medical Research)
2017	Caroline Ong	SingHealth Excellence Award (Distinguished Educator)
2018	Amos Loh	SingHealth Excellence Award (Distinguished Young Leader)
2019	Low Yee	SingHealth GCEO Excellence Award (Outstanding Clinician)



# Appendix:

## Impactful Clinical Process Improvement Projects (CPIP)

Title/ Years	PI	Description
Appendicitis pathway 2005 – 2014	Dr Ong NT Dr C Ong Dr Chen Y	Before 2004, management was based on individual surgeon preference which led to marked variation in terms of antibiotic regimen, timing of feeding/ambulation and length of stay. Two pathways for simple and complex appendicitis aimed to standardise medical and nursing protocols. Review in 2008 confirmed that the pathways had reduced length of stay by 1 day (complicated appendicitis), compliance with antibiotic guidelines without increased infective complications. Subsequent review in 2014 showed maintenance of outcomes with improved compliance to antibiotic guidelines (83 % to 90%) .
Same day admission (SDA) for major surgery 2005-2006	Dr C Ong	Before this CPIP, only 47% of patients suitable for SDA were done as SDA. After project implementation, it rose to 78% the following year without patient safety issues. Subsequently this was extended to other paediatric surgical specialties in KKH and in 2008, a related CPIP project (Preadmission clinic for SDA) enhanced the SDA process with marked improvement in patient/parent satisfaction (90% vs 40%).
Indwelling surgical central venous access devices (CVADs) 2015	Dr A Loh	Preoperative referral processes were streamlined through the development of a dedicated surgical CVAD referral form, promulgation of institutional technical best-practice guidelines and surgical education syllabus, and standardisation of devices and dressing protocols. With implementation of these systems interventions, we have introduced and demonstrated the utility of a novel teaching pedagogy for percutaneous insertion of subclavian venous catheters in children <sup>41</sup> and identified novel post-implantation risk factors and refuted the utility of empirical preoperative prophylactic antibiotics to prevent infections <sup>42</sup> .
Home-Initiated-Programme-to-Prepare-for-Operation (HIPPO) study 2018-2020	Dr Chiang LW Ms T Nair	This randomised controlled trial evaluated the effect of animation video on paediatric peri-operative anxiety. The project collaboration with the Child Life Therapy team found that a home preparation kit improved anxiety levels for elective surgery in children (aged 7-10 years) and parental feedback <sup>43</sup> .
The safer CT scan transfer from Children's Emergency 2018-2019	Dr Chiang LW Ms Jasmine Feng	Based on data from KKH Trauma registry, this CPIP project identified factors causing delay and patient risks during transfer of polytrauma patients from Children's Emergency to CT scan room. After several workflow improvements and education that included in-situ simulation team training, a subsequent audit showed all patients achieved scan transfer times within targets.
Preoperative Team Huddle 2018-2020	Dr Rambha Rai Dr Yap TL Dr Sharon Wan	This multidisciplinary project with Nursing and Paediatric Anaesthesia aimed to improve communications between the various team members in the operating theatre. The huddle involves the whole operating team meeting for a short case-focused discussion to anticipate and avoid intraoperative adverse events. It led to better OT time management and improved relationships between OT personnel. Within 8 months of implementation, compliance improved from 64% to more than 90%. Qualitative feedback was positive especially from nurses and theatre attendants who felt empowered to speak up during team briefs. Team members had a better understanding of the patient, the surgical process and each member's roles.
Decreasing length of stay and number of investigations for non-surgical, non-urgent abdominal pain admissions under Paediatric Surgery 2019-2021	Dr Hana Arbab APN Lok HL	This quality improvement project evolved new standardised management workflows for undifferentiated abdominal pain cases: it included guidance to limit investigation orders according to presenting symptoms, stringent discharge criteria and return-advice information brochure for caregivers upon discharge. The project reduced the median length of stay by 1 day without missing any acute surgical conditions or adverse patient events.

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