



KK Women's and  
Children's Hospital  
SingHealth

IN THIS ISSUE

## ZIKA VIRUS IN PREGNANCY

*Transmitted by the female Aedes mosquito, Zika virus (ZIKV) was declared a Public Health Emergency of International Concern on 1 February 2016. Maternal-fetal transmission has been confirmed, with worrying fetal consequences.*



# SPECIAL DELIVERY

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# Zika Virus In Pregnancy

The authors gratefully acknowledge the contributions of Associate Professor Tan Thiam Chye, Head and Senior Consultant, Inpatient Service, Department of Obstetrics and Gynaecology; Associate Professor Thoon Koh Cheng, Head and Senior Consultant, Infectious Disease Service, Department of Paediatrics; and Associate Professor Jerry Chan, Senior Consultant, Department of Reproductive Medicine, KKH, to this article.

Female *Aedes aegypti* taking a blood meal. ©Environmental Health Institute, National Environment Agency.

*Zika virus (ZIKV) was declared a Public Health Emergency of International Concern on 1 February 2016. The virus has been shown to be associated with fetal consequences in pregnancy and Guillain-Barré syndrome – a rare neurological condition.*

By Dr Kwek Lee Koon and Dr Yung Chee Fu

**Z**IKV is a vector-borne disease belonging to the flavivirus family and is transmitted by the female *Aedes* mosquito. Recently, maternal-fetal transmission has been confirmed and there have been some reported cases of transmission of the virus through sexual contact<sup>1</sup>. There is currently no evidence of ZIKV transmission through breast milk<sup>2</sup>.

The incubation period for ZIKV ranges from three to 12 days<sup>3</sup>. Clinically, ZIKV presents with fever, maculopapular rash, arthralgia, myalgia, headache and conjunctivitis which may last four to seven days. However, the majority (80%) of those infected do not exhibit any symptoms<sup>4</sup>. Currently, there are two key sequelae being linked to ZIKV infection. One of which is the confirmed link between ZIKV and the development of Guillain-Barré syndrome (GBS), a usually rare neurological condition known to be

associated with viral infections such as influenza. To date, 13 countries/territories have reported a rise in GBS incidence or GBS cases with confirmed ZIKV infection. More worrisome are the fetal consequences of ZIKV infection in pregnancy, that has been shown to affect fetal brain development, resulting in intracranial calcification and in severe cases, microcephaly<sup>5</sup>. The risk of developing microcephaly is currently being estimated to be between 0.88 percent and 13.2 percent of those infected during pregnancy<sup>6</sup>. However, the full spectrum of such a teratogenic insult remains undefined.

The first case of ZIKV infection in Singapore was confirmed on 13 May 2016, from a returning visit to Brazil. Intensive vector control activities have been instigated by the National Environment Agency in the vicinity of the case to prevent spread of disease<sup>7</sup>. The Ministry of Health (MOH) has also stepped up

clinical vigilance to ensure early detection of suspect cases, with ZIKV having been added to the list of notifiable diseases.

Currently, MOH is recommending that pregnant women consider postponing non-essential travel to affected areas, and adopt precautions against mosquito bites if travel cannot be avoided. They should monitor their health for ZIKV symptoms for 14 days upon returning to Singapore, and consult a doctor immediately if they have symptoms. Pregnant women with a travel history and who develop symptoms should seek medical attention immediately. Male travellers returning from ZIKV affected areas should adopt safe sexual practices for at least four weeks after their return. If their partner is pregnant they should adopt these precautions throughout the woman's pregnancy.

## **WHO SHOULD BE OFFERED ZIKV TESTING?**

ZIKV is currently detected through reverse-transcription polymerase chain reactions (RT-PCR), which can be performed on urine samples within 14 days of onset of symptoms, and should be done in conjunction with serum testing if collected within seven days of

*ZIKV is currently detected through reverse-transcription polymerase chain reactions (RT-PCR), which can be performed on urine samples within 14 days of onset of symptoms.*

onset of symptoms. A positive result in either sample provides evidence of ZIKV infection. Pregnant women who test positive for ZIKV will be admitted for further management. Patients who test negative should resume routine prenatal care.

ZIKV infection testing should be offered in all individuals suspected to have ZIKV. These refer to individuals with possible exposure to ZIKV (such as recent travel history within two weeks to ZIKV affected areas, living or working in the vicinity of a confirmed case within six weeks of isolation of the confirmed case, living or working in the area of an ongoing ZIKV transmission) who present with fever and maculopapular rash, and any one of the following symptoms: arthralgia, myalgia, headache and non-purulent conjunctivitis<sup>8</sup>. Testing of asymptomatic pregnant women with travel history to affected areas within two weeks may be considered at the discretion of their obstetrician. Testing of pregnant women with travel history more than two weeks past is not recommended; however, serial fetal ultrasound to monitor for fetal abnormalities should be considered if the patient previously displayed signs and symptoms of ZIKV infection. Fetal monitoring is recommended to be done every four weeks to monitor fetal growth and anatomy<sup>2</sup>.

Amniotic fluid testing after 15 weeks' gestation may be considered for pregnant women who test positive for ZIKV or whose



fetus show abnormality following ZIKV exposure. Discussion should be made with the pregnant woman regarding the currently unknown sensitivity and specificity of ZIKV testing on amniotic fluid, and that the result from amniotic fluid testing does not indicate whether the fetus has been affected by ZIKV. Relevant tissues and samples may still need to be tested following delivery to confirm ZIKV infection.

Babies of women who tested positive for ZIKV infection while pregnant, or who present with microcephaly or other

abnormalities, may be tested for ZIKV infection after delivery. Testing is not recommended for healthy babies born to mothers who were not tested, or tested negative for ZIKV infection.

It is clear that ZIKV infection is a global public health threat that may eventually affect our local obstetric population. It is thus imperative that continued vigilance for ZIKV infections be in place, and guidelines for both diagnosis and follow-up be adhered to in suspected or affected pregnant women to identify at-risk fetuses.

#### References:

1. Correspondence: Evidence of Sexual Transmission of Zika Virus. *NEJM*. <http://www.nejm.org/doi/pdf/10.1056/NEJMc1604449>. Accessed on 18/5/16
2. RCOG interim guidelines <https://www.rcog.org.uk/globalassets/documents/news/zika-virus-interim-guidelines.pdf>. Accessed on 18/5/16
3. Public Health England (PHE) Website. <https://www.gov.uk/guidance/zika-virus>. Accessed on 18/5/2016
4. Yung CF, CY Chong, KT Yeo, Liew C, et al. Zika Virus: An Evolving Public Health Threat. *Annals Academy of Medicine*. April 2016, Vol. 45 No. 4
5. Johansson MA et al. Zika and the risk of microcephaly. *NEJM* (2016) e-pub. DOI: 10.1056/NEJMp1605367
6. Cauchemez S et al. Association between Zika virus and microcephaly in French Polynesia, 2013–15: A retrospective study. *Lancet* (2016) e-pub. DOI:10.1016/S0140-6736(16)00651-6
7. Ministry of Health Circular 03/2016: Alert: Zika Virus Infection (Dated 27 January 2016)
8. Ministry of Health Circular 22/2016: Updated guidance on Zika Virus Infection (Dated 19 May 2016)



Dr Kwok Lee Koon, Resident, Department of Obstetrics and Gynaecology, KKH

Dr Kwok Lee Koon completed her MBBS in Singapore and is currently completing her first year with the Obstetrics & Gynaecology Residency Program at SingHealth.



Dr Yung Chee Fu, Consultant, Infectious Disease Service, Department of Paediatrics, KKH

Dr Yung Chee Fu obtained his medical qualifications from the University of Bristol and postgraduate training from the University of Cambridge. He is a Fellow of the Faculty of Public Health, Royal College of Physicians in the United Kingdom. Dr Yung has a keen interest in the epidemiology of infectious diseases, vaccines, outbreak control and public health.

# The Pain Of Providing Relief

*Since 3,400 BC, opium has been used for both euphoric and medicinal purposes. The "milk of the poppy", an euphemism for sap derived from the poppy plant or "Hul Gil" (known as "Joy Plant" in ancient Sumeria), is the natural source of opioids such as codeine.*

By Dr Serene Lim

Unfortunately, opium's addictive potential generates an ongoing demand and black-market for it as a recreational substance of abuse. From the Anglo-Chinese opium wars of the 1800s, history has documented a pattern of illicit use and associated bloodshed that have long besmirched its otherwise noble reputation for potent analgesia. Moreover, its common adverse effect, potentially lethal respiratory depression whether from opioid misuse or inappropriate dosing, make it a double-edged sword, bringing either panacea or death.

## OPIOID-RELATED DEATHS

Codeine-implicated deaths have more than doubled worldwide in this millennium.

In 2012, a series of paediatric deaths were reported in North America after codeine analgesia post-tonsillectomy and adenoidectomy<sup>1</sup>. Prescriptions were dose-weight appropriate, but the children had additional risk factors of young age, obstructive sleep apnoea (OSA) and obesity, which in hindsight would have benefitted from dose reduction or an opioid-free prescription.

Further compounding the codeine conundrum is the wide variation (genotypically and phenotypically), in its metabolism. Typically, only 30 percent of codeine is converted into morphine by the CYP2D6 enzyme in the liver. However, CYP2D6 activity varies widely between ethnicities; poor metabolisers (predominantly

Asians and Pacific Islanders) hardly convert any codeine to morphine – resulting in poorer analgesic effect. Conversely, ultra-rapid metabolisers (commonly of Middle Eastern and North African descent) run the risk of rapid morphine accumulation and over-sedation whilst Greeks, Caucasians and African Americans incur an intermediate risk.

In 2014, the United States documented an alarming number of opioid-related overdoses, culminating in 28,000 deaths – half of which were iatrogenic<sup>2</sup>. This prompted medical students from Harvard University to demonstrate and push for more comprehensive education on appropriate opioid prescription and pain management. The Centres for Disease Control and Prevention have recently revised opiate prescription guidelines in an attempt to tackle the burgeoning opioid crisis.

Post-mortem investigations into the drug-related deaths of newsworthy celebrities invariably unveil an opioid amidst the implicated poly-pharmaceutical array.

Local audits of opioid-related morbidity and mortality have attributed causalities such as prescription error, polypharmacy

(augmenting its sedative effects), inadequate monitoring and failure to detect over-sedation or respiratory compromise, failure to appreciate the patient's deteriorating medical condition or high risk profile, and failure to call for help promptly. Patient education and stringent protocols should be intensified to address these issues and prevent poor outcomes.

### ADDICTION AND ADOLESCENTS

Although the risks of opioid addiction are low for children with acute postoperative or procedural pain, a 2015 publication by R Miech et al<sup>3</sup> highlights the potential for a 33 percent increase in the risk of future opioid misuse in school-aged children exposed to opioid prescription.

The study follows 6,220 adolescents in the United States who had been legitimately prescribed opioids, from the age of 17 to 23 years. Regardless of whether they had little experience with illegal drug use, or personally disapproved of marijuana use, the adolescents had a two-to-three fold increase in the risk of future opioid misuse. Cited reasons for the misuse apart from pain relief were to relax and get high.

### OPIOID DIVERSION

Accidental poisonings and misuse occur when legal opioid prescriptions get diverted to another consumer (other than the patient). Opioid diversion is less common in Singapore because of its strict drug laws. However, the Health Sciences Authority (HSA) uncovered an unhealthy trend of codeine cough syrup labelled for export which was diverted to unlicensed local suppliers. With effect from 2009, all sales of codeine-containing preparations for export will require prior HSA authorisation and approval.

*R Miech et al<sup>3</sup> highlights the potential for a 33 percent increase in the risk of future opioid misuse in school-aged children exposed to opioid prescription.*

As clinicians, we should continue to reinforce measures that prevent opioid diversion. These include: conscientious opioid prescription, limiting duration of supply thereby enforcing regular follow-up with preferably a consistent physician who has educated the patient on correct prescription, the potential for harm and contracted an opioid agreement.

### WHICH OPIOID AND FORMULATION TO USE?

Fentanyl patches can take up to 17 hours to reach steady state and should not be used in an emergency, nor for the treatment of acute nor incident pain. They should not be used in the opioid-naïve or where the patient's opioid requirement and response to opioid therapy is unknown. Dose adjustments mandate follow-up monitoring for at least 24 to 48 hours.

The United States Food and Drug Administration has recommended that codeine be contraindicated in ultra-fast metabolisers, and avoided in patients with OSA as well as lactating mothers who are breast-feeding. Its use is also cautioned in children, and limited to those over 18 years.

Oxycodone is more suitable than morphine in patients with renal insufficiency. Extended-release formulations should (ideally) be reserved for cancer-related pain, and not used for acute pain.

*Current recommendations focus on the restoration of function and mobility through a multi-modal rehabilitative approach.*

### NEW INSIGHTS INTO OPIOID IMMUNOCHEMISTRY

Both therapeutic and chronic use of opioids have been shown to compromise optimal adaptive and innate functioning of the immune system by decreasing the proliferative capacity of macrophage progenitor cells and lymphocytes.

Recent research in opioid immunochimistry has revealed that opiates introduced through the central nervous system activate the body's innate immune pattern recognition receptors, causing a pro-inflammatory reaction which elevates neuronal excitability – leading to heightened pain states and decreased analgesic effect.

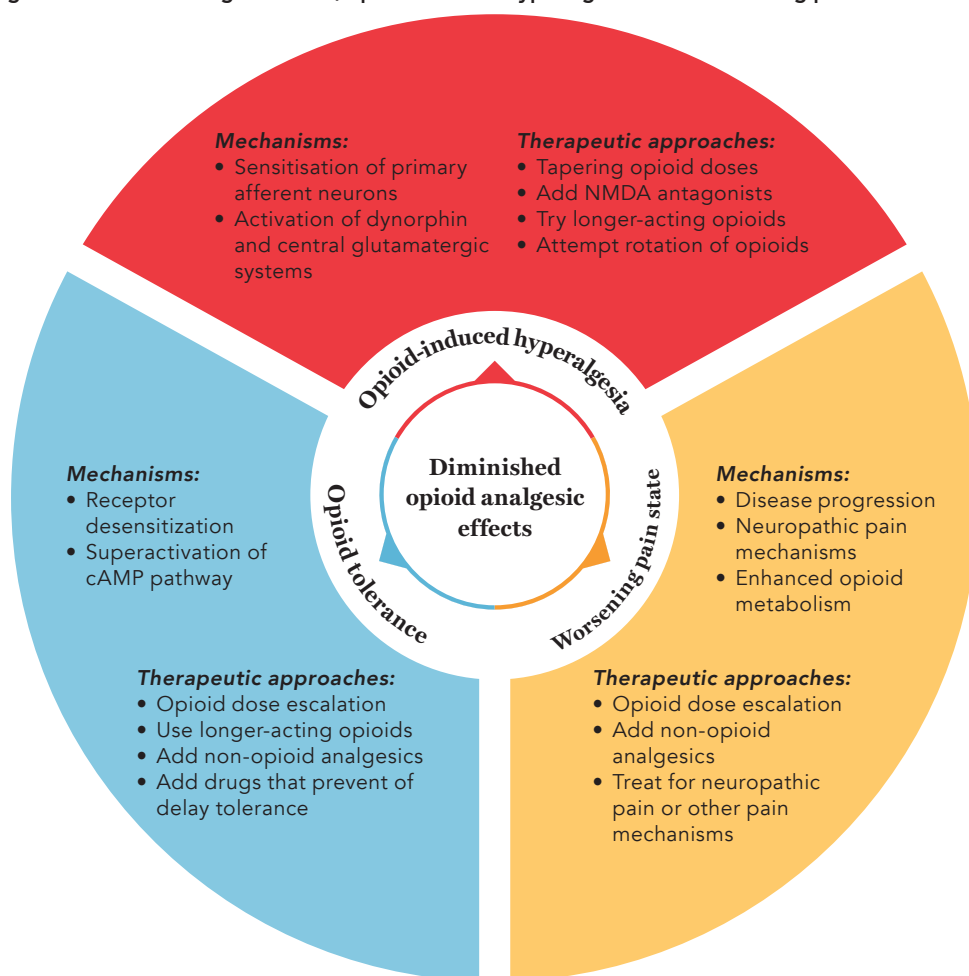
The resultant neuronal excitability and reactivity amplifies pain and also accounts for opioid tolerance. Amitriptyline and/or ultra-low-dose naltrexone/ naloxone appear to modulate and ameliorate this wind-up.



## OPIOID TOLERANCE VS. ADDICTION

Opioid tolerance can develop within just one week of a continuous opioid infusion, and is a common phenomenon in patients with chronic pain and those requiring intensive care. This necessitates continual dose escalations in order to maintain analgesic efficacy, creating problems with subsequent attempts at de-escalating doses, resulting in precipitation of withdrawal symptoms upon weaning. Imputed causes and suggested management are listed in Figure 1. In particular, concomitant use of an antagonist as well as an NMDA receptor antagonist (e.g., ketamine) have been shown to ameliorate this phenomenon.

Figure 1. Differentiating tolerance, opioid-induced hyperalgesia and a worsening pain state.



Opioids of increased potency are associated with increased propensity for tolerance. The following opioids demonstrate an increasing potential for producing tolerance: morphine, fentanyl, remifentanyl, with acute tolerance documented for the latter. It is important not to confuse tolerance with addiction, as the latter has associated social stigma and its repercussions. Opioids should not be withheld from the opioid-tolerant who require strong analgesics for disease progression and worsening pain.

## CHRONIC OPIOID THERAPY (COT) AND CHRONIC NON-CANCER PAIN

In the face of persistent unrelieved pain, especially in chronic non-cancer pain, medical professionals face the conundrum of how to continue or escalate opioid therapy safely. Although it is humane to alleviate debilitating pain and suffering, current evidence does not show significant long-term benefits from continued opioid use in non-cancer-related pain.

Current recommendations focus on the restoration of function and mobility through a multi-modal rehabilitative approach. Drug or opioid-dependence is discouraged, expectations are managed (e.g., not to expect zero-pain) and pain coping skills cultivated. Non-pharmacological approaches (e.g., acceptance and cognitive-behavioural modifications) are emphasised as equally important management tenets.

### Conclusion

Continuing the progress made in espousing good pain management in recent decades, medical professionals should remain current in the knowledge and stringent practice of safe opioid prescription to ameliorate the potential for opioid addiction, abuse and diversion.

#### References:

1. Kelly LE et al. More codeine fatalities after tonsillectomy in North American Children. *Pediatrics*, May 2012: 129 (5)
2. Understanding the Epidemic | Drug Overdose | CDC Injury Center [www.cdc.gov/drugoverdose/epidemic](http://www.cdc.gov/drugoverdose/epidemic) - Mar 14, 2016 - Drug overdose deaths in the United States hit record numbers in 2014.
3. Miech R et al. Prescription opioids in adolescence and future opioid misuse. *Pediatrics* Oct 2015: peds 2015-1364; DOI:10.1542/peds.2015-1364



Dr Serene Lim, Senior Consultant, Department of Paediatric Anaesthesia, KKH

Dr Serene Lim has been actively involved in paediatric pain management and education for almost 20 years. In addition to her MBBS and M Med (Anaesthesia) from the National University of Singapore, Dr Lim also has a diploma in acupuncture from Singapore College of Traditional Chinese Medicine.

# Giving The Gift Of Speech

*The evolving role of the multidisciplinary paediatric tracheostomy clinic.*

By Rebecca Tse

**H**umans begin developing communication skills from birth, with vocalising and cooing during infancy forming the foundations for eventual speech development. However, for babies and toddlers who require a tracheostomy, gaining speech and communication proficiency can be challenging.

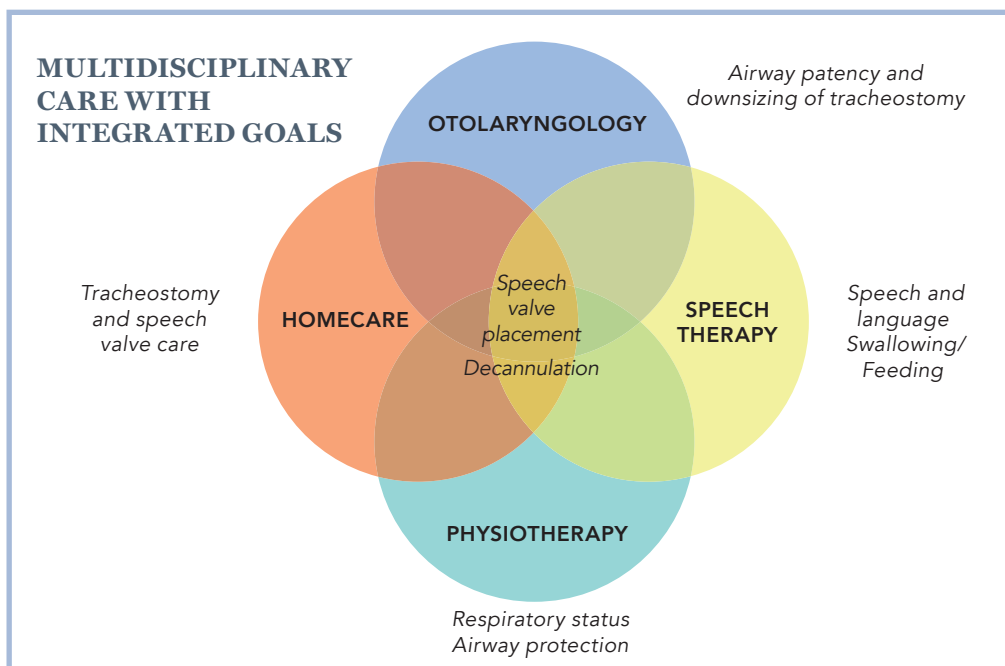
To give children with tracheostomies the best chance of achieving their speech and language developmental milestones within the optimal age range, the Paediatric Tracheostomy Clinic at KK Women’s and Children’s Hospital (KKH) is taking a multidisciplinary, integrated approach.

“A child with a tracheostomy has a tube inserted into a hole made in the neck and windpipe to provide ventilation support. This can cause problems with functions involving the airway – such as swallowing, feeding, respiration, vocalisation and speech – which may persist even after the tracheostomy tube is removed,” says Dr Annette Ang, Senior Consultant, Department of Otolaryngology, KKH.

“To facilitate the restoration of normal phonation and language development, successful speaking valve placements and decannulation are two key milestones which need to occur,” adds Ms Desiree Lau, Head, Speech Language Therapy Service, KKH.

*“To facilitate the restoration of normal phonation and language development, successful speaking valve placements and decannulation are two key milestones which need to occur.”*

Ms Desiree Lau  
Head, Speech Language Therapy Service, KKH



## TAKING A UNITED APPROACH

Dr Ang and Ms Lau are members of the multidisciplinary team behind the Paediatric Tracheostomy Clinic, comprising otolaryngologists, speech therapists, physiotherapists, homecare nurses and dietitians.

Patients at the clinic benefit from “one-stop” hospital reviews, meaning all relevant healthcare specialists are present during the patient’s medical appointment. “One-stop reviews help give caregivers and patients a well-rounded understanding of their condition and progress, which makes it more efficient to address issues as they arise,” says Dr Ang. “They also help families save time and transportation costs.”

At KKH, the most common reasons for paediatric tracheostomies include respiratory or neuromuscular problems, and airway obstruction or anomalies.



The clinic's youngest patient is aged four months, and the oldest is eight years.

The team works with patients and their caregivers to create a holistic long-term management plan and integrated goals for feeding, vocalisation, speech proficiency and eventual decannulation. Caregivers are also taught how to continue tracheostomy care, and given speech and physiotherapy intervention exercises to be done at home.

Depending on the type and extent of their medical condition, patients will experience varying degrees of proficiency with vocalisation and speech. "Generally, the earlier a child begins intervention and starts using a speaking valve, the better their prognosis will be for communication and subsequent speech and language development," says Ms Lau.

A retrospective review from 2013 to 2015 indicated that nearly 60 percent of children with tracheostomies seen at the clinic were successfully fitted with speaking valves, and subsequently able to vocalise. Eighteen percent achieved decannulation. A large proportion of these groups of children achieved these key milestones within the ages of three and four.

The average duration of a paediatric tracheostomy is three years. "It can be a long journey, particularly for patients with congenital physiological anomalies or those requiring life-long respiratory support," says Ms Seet Soh Cheng, Nurse Clinician, Paediatric Homecare Service, KKH. "However long it takes, we work alongside each patient and their family to help the child reach their fullest potential."

*"However long it takes, we work alongside each patient and their family to help the child reach their fullest potential."*

Ms Seet Soh Cheng  
Nurse Clinician,  
Paediatric Homecare Service, KKH



Ex-tracheostomy patient, Caden, with his multidisciplinary care team from the Paediatric Tracheostomy Clinic.

### ***Transforming a child's future: A Case Study***

Prenatally diagnosed with an oropharyngeal tumour completely obstructing his airway, Caden was delivered via an ex-utero intrapartum treatment (EXIT) procedure, which involved undergoing a tracheostomy at birth to secure his airway. The subsequent excision of the tumour also resulted in the removal of two-thirds of his tongue.

From the time of Caden's birth, he presented with profound oropharyngeal dysphagia and orofacial hypersensitivity. The KKH Homecare team taught Caden's family how to care for him and facilitate his daily activities. This included tracheostomy and gastronomy care, secretion management, tube feeding, and the use of monitoring equipment.

As Caden grew older, the team observed that he had speech and language delay, with communication limited to nonspecific gestures. He did not have the ability to vocalise due

to the presence of the tracheostomy. To manage Caden's difficulties with swallowing and decrease his orofacial hypersensitivity, very minimal taste trials involving a spoon dipped in water or puree were prescribed to accustom him to the sensation of oral feeding and food textures, and to facilitate swallowing practice.

Tube-feeding ensured that he obtained optimal nutrition during this time. Consistent home practice with the speaking valve reduced his orofacial hypersensitivity and improved his acceptance of oral feeding.

Following assessment for suitability, Caden was fitted with a speaking valve at one year six months, and successfully voiced. He was initially only able to tolerate wearing the speaking valve for less than 20 minutes each time.

During clinic sessions, Caden performed respiratory exercises with the help of the physiotherapist, such

as blowing bubbles, to help improve his ability to wear the speaking valve for longer periods. His caregivers were also taught how to provide language stimulation and encourage spontaneous vocalisations.

Following a surgical jaw distraction to improve swallowing and secretion management, Caden was successfully decannulated in late 2015.

Today, despite his shortened tongue, Caden is able to consume very minimal amounts of pureed foods orally, and speak in one-to-two word utterances. Lively, inquisitive and confident, he responds readily to questions and has met all but one of his developmental milestones.

Caden continues to undergo therapy to better his swallowing and articulation skills, to further improve his quality of life.

# Transforming Medical Imaging For Children

*Pursuing the latest medical imaging technologies, KKH is the first dedicated children's hospital in South East Asia to unveil the SOMATOM® Force, enabling safer, more comfortable and higher accuracy diagnostic imaging for children.*

By A/Prof Marielle Fortier

**T**imely state-of-the-art imaging is crucial for patient diagnosis and management. However, when performing paediatric medical imaging, adjusting radiation exposure for an infant's or child's size is critical, as this patient demographic is more sensitive to radiation than adults. Having one or more medical conditions may also further increase a child's radiosensitivity.

At KK Women's and Children's Hospital (KKH), paediatric-specific imaging protocols are "child-sized" and customised to produce high quality diagnostic images using the least possible amount of radiation – as low as reasonably achievable (ALARA). These enable us to consistently obtain diagnostic scans for patients at radiation doses lower than the recommended guidelines for radiation exposure of 1mSv per person, per year.

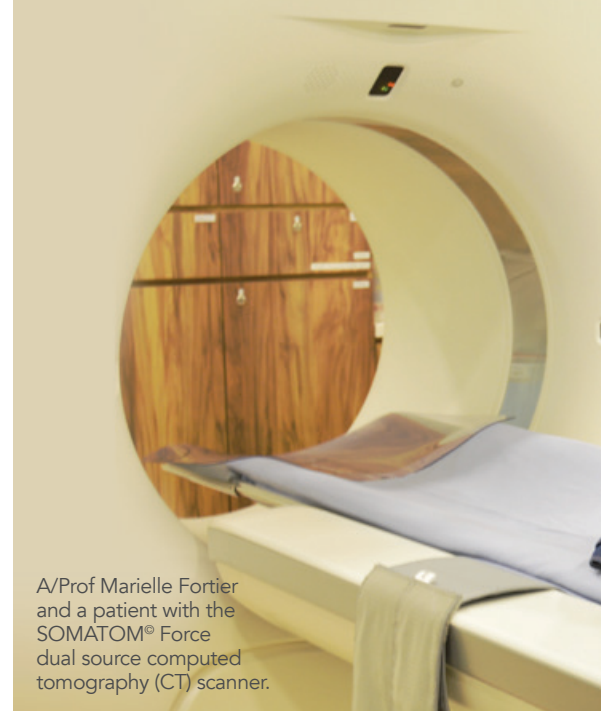
## REDUCING RADIATION DOSAGE FOR CHILDREN

Since 2015, KKH's arsenal of diagnostic and interventional tools has been augmented with the introduction of a third-generation SOMATOM® Force dual source computed tomography (CT) scanner, reducing the average dose of radiation per scan to less than half of the hospital's previous standard. This enables patients as young as a few days old with challenging pathologies to be imaged with increased safety, effectiveness and comfort.

The dual source CT scanner utilises a number of cutting-edge technologies to reduce radiation exposure to the patient. During the image acquisition phase, spectral pre-filtration removes unwanted low-energy x-ray quanta from the beam before they reach the patient.

In addition, radiographic exposure settings are automatically calibrated for each patient and anatomical area in order to optimise both contrast and radiation dose. As the beam passes through the patient, the scanner's detectors further improve utilisation of low signal. These measures result in outstanding spatial resolution and soft-tissue contrast at unprecedentedly low radiation levels.

On top of this, advanced modelled iterative reconstruction is used to produce extremely high quality diagnostic images, even as radiation levels are kept lower than ever.

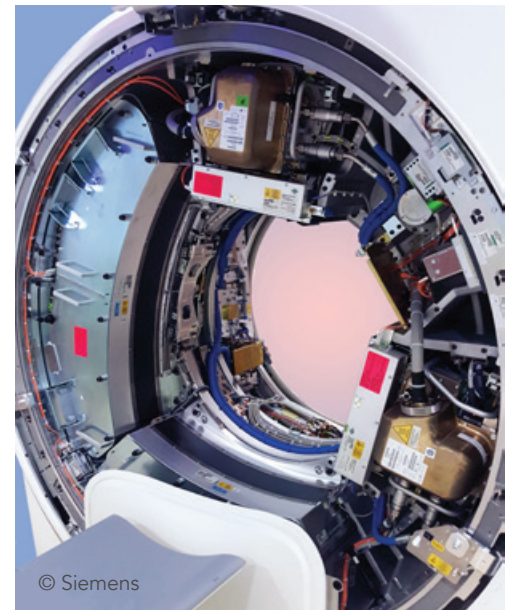


A/Prof Marielle Fortier and a patient with the SOMATOM® Force dual source computed tomography (CT) scanner.

## LOWERING CONTRAST VOLUME

As the iodinated contrast used in CT scans may exacerbate renal insufficiency, it is prudent to reduce the volume of contrast administered. Intravenous contrast for CT scans is seen more clearly when scanning at lower kV; the scanner is able to perform CT scans at 70 to 90 kV as compared to the 100 to 120kV in most other scanners even for adults.

Consequently, scans can now be carried out with less contrast, preserving the necessary enhancement needed for diagnosis, while simultaneously reducing radiation dose.



© Siemens



### SCANNING WITHOUT SEDATION

Faster table speeds of up to 737mm per second also enable the majority of paediatric scans to be performed without breath-hold, sedation or beta blockers. The high speeds of scanning benefit some of our adult patients, as a significant number may have difficulty holding their breath, be unconscious or otherwise physically uncooperative. Where this demographic might previously have had to be sedated, or were scanned with suboptimal results, motion artefacts can now be eliminated as scans can be routinely completed in under one second.

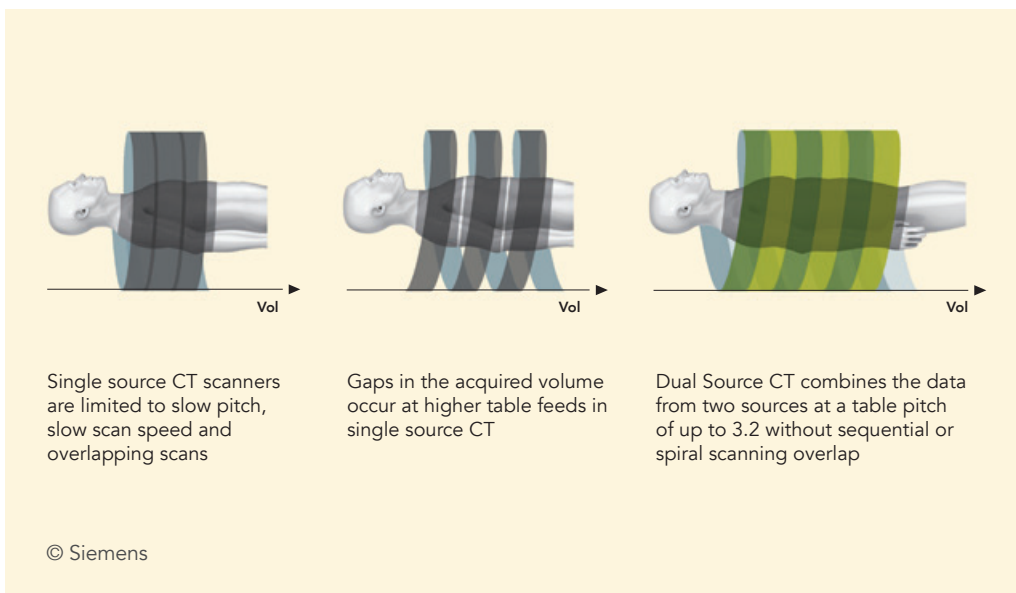
### LESS INVASIVE CT IMAGING

To date, advancements in CT cardiac imaging have opened up new frontiers for KKH to pursue a wider range of less invasive medical imaging services, and enabled better characterisation of pathologies such as coronary artery aneurysms and major aortopulmonary collateral arteries (MAPCAS) in infants and young children.

One such example is coronary computed tomography angiography (CCTA) – a non-invasive form of CT cardiac imaging. The use of CCTA was previously not possible in young children due to high heart rates, inability to perform breath-holding on command, and radiation exposure concerns. Using advanced technology, we are able to overcome these limitations and perform safer cardiac imaging for infants even at high or inconsistent heart rates.

Harnessing advanced technologies empowers KKH to conduct potentially life-saving medical imaging at optimised radiation exposure with little-to-no need for sedation or the use of beta blockers. Further, by maximising the information acquired and usefulness of each CT scan, we are able to keep the number of scans – and thus the patient’s radiation exposure – to an absolute minimum.

Collectively, these measures have brought about unprecedented levels of safety and comfort, as well as improved imaging for the children in our care, as they progress to recovery.



#### The dual source CT scanner features:

- Two X-ray detector systems rotate simultaneously, capturing image data in approximately half the time required with conventional technology.
- Faster speed of acquisition to eliminate motion blurring, whilst reducing radiation dose by more than 50 percent as compared to equivalent scans on conventional scanners.

The resulting high quality images may potentially eliminate the need for other diagnostic examinations and thus further decrease radiation exposure for the patient.

Associate Professor Marielle Valerie Fortier, Head and Senior Consultant, Department of Diagnostic and Interventional Imaging, KKH  
 Deeply committed to fostering an academic medical culture, A/Prof Marielle Fortier enjoys designing multidisciplinary and radiology workshops and mentoring junior colleagues, and is currently spearheading magnetic resonance imaging research as part of the 'Growing Up in Singapore Towards healthy Outcomes' (GUSTO) study. A/Prof Fortier is Adjunct Associate Professor, Duke-NUS Medical School, Vice Chair of the Clinical Services-Quality, Radiology Sciences Academic Clinical Programme, SingHealth, and Adjunct Investigator, Singapore Institute for Clinical Sciences, Agency for Science, Technology and Research, Singapore.



# Kick-Starting Positive Change

*KKH team creates acute paediatric resuscitation course to strengthen Cambodia's healthcare system.*

By Shawn Tan and Vincent Neoh

In February 2016, the pair of us medical students from Lee Kong Chian School of Medicine, National Technological University (NTU), were thrilled to accompany a medical team from KK Women's and Children's Hospital (KKH) travelling to Kampong Chhnang, Cambodia, to train local healthcare providers in acute paediatric emergency resuscitation.

The team's purpose was to equip Cambodian healthcare professionals with the knowledge and skills to respond in situations where a child's life might be threatened without immediate medical

intervention, and enhance the care they could provide to their community.

Over four days, the team conducted an Acute Paediatric Emergency Resuscitation Course (APEC) for 50 doctors, nurses and midwives from three district hospitals and 39 village health centres spread across Kampong Chhnang.

## OVERCOMING LANGUAGE BARRIERS

The APEC was conducted through theory sessions and circuit-style interactive practical and skills stations. As few local

course participants were fluent in English, the team had to rely heavily on translators to convey the course material. To mitigate the loss of information in translation, and help course participants fully grasp the concepts being taught, they were quizzed from time to time.

Course participants were given different scenarios of cardiac arrhythmia and asked to respond appropriately, using their newly-acquired knowledge and skills. Their responses revealed any gaps in their knowledge, allowing the team to address these with a demonstration of the proper technique coupled with step-by-step explanations.

The participants were then asked to repeat the scenario, to demonstrate that they had successfully acquired the knowledge and skills to carry out the appropriate intervention.



KKH team members together with medical students from the Lee Kong Chian School of Medicine, NTU. Clockwise from top left – Nurse Clinician Rajammal P Kaliappan, Dr Khoo Zi Xean, A/Prof Ng Kee Chong, Dr Nirmal Kavalloor Visruthan, Dr Teng Sung Shin, A/Prof Annette Jacobsen, Mr Shawn Tan, Mr Vincent Neoh, Ms Judith Wee and Nurse Manager Lim Lee Ngoh.



Singapore

## DEBUNKING HEALTHCARE MYTHS

Healthcare professionals in Kampong Chhnang often refrain from administering defibrillation, believing that the procedure is tantamount to electrocution, and holds little or no medical benefit. A common fear is that the patient will die in the process.



Dr Teng Sung Shin, Registrar, AST, Children's Emergency Department, KKH (left) demonstrating paediatric intraosseous needle insertion into bone.

To correct these misconceptions, the team explained the science behind defibrillation, and the medical reasons behind its necessity in treating certain forms of cardiac arrhythmias. In addition, it was stressed to the course participants that defibrillation is a common procedure used around the world that has been shown to improve patient outcomes, giving anecdotal evidence to further illustrate its benefits.

## ENHANCING RESPIRATORY SUPPORT

In Cambodia, it is not uncommon for healthcare facilities to have limited access to equipment, technology and staff while seeing substantial numbers of patients.

A village health centre in Kampong Chhnang (equivalent to a small clinic in Singapore), equipped with only a few consultation rooms and beds, can see up to a few hundred patients in a day from surrounding villages.

To help ease the technology shortage and address the lack of replenishable oxygen in these remote health centres, the team introduced an improvised design of a bubble continuous positive airway pressure (CPAP) machine from existing pressure pumps.

The machine was co-developed by team leader Associate Professor Ng Kee Chong, Chairman, Division of Medicine; Dr Nirmal Kavalloor Visruthan, Associate Consultant, Neonatology, KKH; and our local partner non-governmental organisation, Water and Health (WAH).

Constructed at a fraction of the cost of a commercially-available machine, the air-driven bubble CPAP design obviates the need for oxygen tanks for initial respiratory resuscitation and support. It is hoped that this cost-saving design and much lower price will increase the machine's prevalence in local healthcare facilities, and enhance respiratory support for paediatric emergencies in the village health centres.

WAH saw to the team's various needs of transport, course venues, logistics and food, enabling the trip to proceed seamlessly. The NGO works with companies to improve hygiene practices and access to



A/Prof Ng Kee Chong (left) and Dr Nirmal Kavalloor Visruthan (centre) with their improvised bubble CPAP machine design.

clean water for Cambodian communities, and had provided invaluable aid during previous KKH medical outreach efforts to Kampong Chhnang in 2013 and 2014 – efforts which eventually saw the high maternal mortality rates drop by 75 percent.

## TRAINING THE TRAINER

Following the old adage: 'give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime', a KKH team will be returning to Kampong Chhnang to conduct a second round of APEC training in the latter half of 2016, together with several potential trainers selected from the local healthcare community.

Investing in medical training and education has a transforming effect on healthcare and a powerful flow-on effect beyond just treating illnesses. Patient education, outcomes, prevention, health and wellness are also improved. In addition, cross-pollination of medical best practices are useful to strengthen national health guidelines and regulations.

We are glad to have been part of KKH's partnership efforts with fellow medical colleagues in Cambodia to help build the capacity of the healthcare system and improve the health of Cambodia's people.

# KKH TEAMS RECEIVE NATIONAL HONOURS FOR CARE TRANSFORMATION

## SERVING THE COMMUNITY THROUGH TEAMWORK AND INNOVATION



At the Excellence in Public Services Awards 2016 – Deputy Prime Minister Mr Teo Chee Hean (centre), and KKH Chief Executive Officer, Prof Kenneth Kwek (right) with OPAS team members Ms Irene Quay, Ms Serene Chin (second and third from left), and PTSS team members Ms Lynn Soh and Ms Lim Xin Yi (second and third from right).

In May, the Psychosocial Trauma Support Service (PTSS) at KK Women's and Children's Hospital (KKH) received the PS21 Distinguished Star Service Team Award for stellar multidisciplinary teamwork at the Excellence in Public Service Awards 2016 – a national event to recognise outstanding service and best practices in public service.

The PTSS team partnered philanthropic organisation, Temasek Cares, in 2014 to launch the Temasek Cares KITS (Kids in Tough Situations) programme, which provides trauma-focused therapy in the community to children with emotional and psychological difficulties arising from traumatic events.

The effectiveness of the collaborative effort was evidenced in June 2015, when the KITS programme benefitted children who were caught in an earthquake in Sabah, Malaysia.

The KKH Pharmacy and Integrated Health Information Systems (IHIS) were also honoured with the Best Practice Award for service delivery, in recognition of their collaborative efforts to improve medication safety.

The team had spearheaded the implementation of the Outpatient Pharmacy Automation System (OPAS) at KKH Emergency Pharmacy. OPAS is an integrated robotic solution that automates more than 90 percent of medication dispensing workflow, enabling the hospital to accurately and swiftly dispense a wide array of medicines around the clock, and reduce the potential for human error.

The pharmacy automation incorporates innovative, patent-pending technologies, such as a robotic Bottle Dispensing System (BDS), flag labelling and integration of the inpatient and outpatient medication systems.

## REDESIGNING HEALTHCARE DELIVERY WITH INFO-TECH



Minister for Health, Mr Gan Kim Yong (left) with Dr Shephali Tagore at the National Health IT Excellence Awards 2015.

Dr Joseph Manuel Gomez was named 'Champion for Health IT Excellence' at the National Health IT Excellence Awards 2015.

KKH and Integrated Health Information Systems (IHIS) partnership was recognised for excellence in providing quality of care through information technology at the National Health IT Excellence Awards held at the National Health IT Summit 2016.

The 'TrustedCare – Process Redesign for Elective Caesarean Section Care' electronic data system replaces paper-based records, integrating clinical, operational and financial data to better support healthcare delivery to women undergoing caesarean section.

"With this powerful tool, we are now better able to track the patient care journey and coordinate multidisciplinary care as we continue pursuing optimal clinical outcomes for our patients," says Dr Shephali Tagore, Senior Consultant, Department of Maternal Fetal Medicine, KKH, who was a key coordinator for the project.

Dr Joseph Manuel Gomez, Director, Medical Informatics and Head and Senior Consultant, Neonatal Intensive Care Unit, KKH, was also named 'Champion for Health IT Excellence' at the National Health IT Excellence Awards 2015.

Chairman of the KKH Medication Safety Committee, Dr Gomez is a strong supporter of leveraging Information Technology to transform the delivery of healthcare, improve the quality of care in an acute setting and uplift operational efficiency. He was instrumental in the introduction of KKH's Closed Loop Medication Management System.

# KKH Co-Develops Eczema Smartphone App For Children

**A** new child-friendly eczema smartphone app is helping young patients with eczema take control of the itchy skin condition.

The iControl Eczema app, which is available for free on Apple and Android platforms, is designed to help children and their parents assess their eczema daily, track and share their progress with their doctor.

Co-developed by KK Women's and Children's Hospital (KKH), the School of Information Technology, Nanyang Polytechnic, and Hyphens Pharma, the iControl Eczema app has the following features:

"Eczema is a chronic skin condition that can recur with varying severity throughout a child's life. Poorly-controlled eczema can cause an affected child to experience significant discomfort, anxiety and even depression, leading to low self-esteem, and poor school performance. This can have a profound impact on quality of life for both the child and their family," says Dr Mark Koh, Head, Dermatology Service, KKH, who provided expert inputs during the app development phase.

"As many of our patients with eczema are children, the iControl Eczema app is based on the Patient Eczema Severity Time [PEST] score<sup>1</sup>, a new simple measure of acute and remitting eczema severity – designed to be easy for parents to use in assessing children too young to vocalise their own eczema assessment.

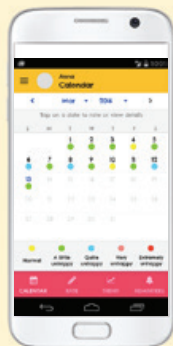
However, the app is suitable for patients of all ages, and can even be set to remind its user to complete their daily moisturising or topical medication regimen."



01

## DAILY ECZEMA ASSESSMENT

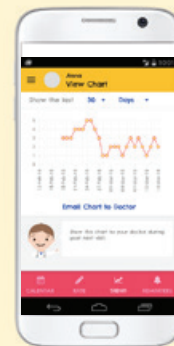
Assess eczema on a daily basis, snap a photo and record the application of topical creams or medication.



02

## ECZEMA TRACKING CALENDAR

Keep track of daily eczema scores over time



03

## ECZEMA PROGRESS CHART

Easy way to update the doctor during clinic visits

### References:

1. Mason JM et al. 'Improved emollient use reduces atopic eczema symptoms and is cost neutral in infants: before-and-after evaluation of a multifaceted educational support programme'. *BMC Dermatol.* 2013; 13:7. doi: 10.1186/1471-5945-13-7.

## Abnormal Uterine Bleeding: Understanding Endometrial and Cervical Cancer

This forum for general practitioners and family physicians will discuss the management of women with abnormal uterine bleeding, focusing on endometrial and cervical cancer as a cause.

Get updates on fertility preservation in young women with endometrial cancer, options for screening and prevention, bariatric surgery for women at risk of endometrial cancer, human papillomavirus (HPV) testing in primary screening for cervical cancer, and HPV vaccines.

Date : 26 November 2016 (Saturday)

Time : 2.00pm to 4.00pm

Fee : \$10 per participant (Lunch will be provided)

Venue : KKH Auditorium, Training Centre, Level 1, Women's Tower

CME points will be accredited.

For more details, please call 6394-8746 (Monday to Friday, 8.30am to 5.30pm) or log on to [www.kkh.com.sg/events](http://www.kkh.com.sg/events).





*Ms Rani Krishnan, Nurse Manager,  
Ward 32, KKH, caring for a newborn baby.*



**PATIENTS. AT THE HEART OF ALL WE DO.**



**KK Women's and  
Children's Hospital**  
SingHealth

#### ABOUT KK WOMEN'S AND CHILDREN'S HOSPITAL

Founded in 1858, KK Women's and Children's Hospital (KKH) is a recognised leader in Obstetrics, Gynaecology, Paediatrics and Neonatology. The 830-bed academic medical institution is Singapore's largest tertiary referral centre for high-risk women's and children's conditions. More than 600 specialists adopt a multi-disciplinary and holistic approach to treatment, and harness compassion, medical innovations and technology to deliver the best medical care possible.

Accredited as an Academic Medical Centre, KKH is a major teaching hospital for all three medical schools in Singapore, Duke-NUS Medical School, Yong Loo Lin School of Medicine and Lee Kong Chian School of Medicine. The Hospital also runs the largest specialist training programme for Obstetrics and Gynaecology and Paediatrics in the country. Both programmes are accredited by the Accreditation Council for Graduate Medical Education International (ACGME-I), and are highly rated for the high quality of clinical teaching and the commitment to translational research.



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