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Spark

by NCIS

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A Touch of HOPE

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5 Lower Kent Ridge Road, Singapore 119074

Please address comments to **ncis_comms@nuhs.edu.sg**

Chief Medical Advisor
Professor Chng Wee Joo

Chief Medical Editor
Dr Chee Cheng Ean

Publishing Agency
Cubiz Pte Ltd

Editorial Team
Dr Choo Bok Ai
Dr David Tan
Dr Tang Siau-Wei
Dr Yong Woon Chai
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Editor's NOTE

Welcome to the first issue of SPARK by NCIS! I am excited to introduce you to this new publication by the National University Cancer Institute, Singapore (NCIS). This biannual magazine will feature news stories, events and profiles highlighting the most current cancer-related news on prevention, treatment and research at the NCIS.

2015 was marked by the SG50 celebrations and was a memorable year for Singapore. Here, at the NCIS, 2015 was also an eventful year marked by significant advances: a major milestone achieved by our Radiation Oncology Department with the treatment of its 100th patient with stereotactic ablative radiation therapy; the maturity of the home care programme, aimed at extending cancer care to our patients in their own home environment; the continued growth of our early phase clinical trials programme and the coming of age of a novel cancer treatment in the form of cellular immunotherapy. You can read more about these highlights in this issue. The new year ahead looks promisingly busy as we continue to strive to improve the lives of our cancer patients through research, clinical care and education – all in line with our conviction here at the NCIS that ***Every Person Matters.***

We hope that with SPARK by NCIS, we will be able to foster closer ties with you – our colleagues within and outside our institution and our community partners. Please do not hesitate to contact us should you feel that we may be able to highlight topics in our future issues that may be of particular interest or benefit to you, your practice and your patients.

Happy reading, Happy New Year and best wishes for 2016!

Dr Chee Cheng Ean
Chief Medical Editor


NCIS
Evolving from Present to Future
Cancer Centre
Pusat Barah
National University
Cancer Institute, Singapore
Yong Siew Yoon Wing


4.5m
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2 Kent Ridge Wing
NO ENTRY
NUH
Medical Centre
VALET PARKING $6.00

OUR BEGINNINGS

Although the National University Cancer Institute, Singapore (NCIS) was officially formed in 2008, there has been a provision of oncology services at the National University Hospital (NUH) since 1988 with the establishment of the first Ambulatory Oncology Centre at the Dentistry Wing of the NUH. In 2000, the NUH Oncology Centre and Radiotherapy Centre merged to form The Cancer Institute (TCI) with Professor John Wong at the helm. Later in 2007, the Ministry of Health (MOH) announced the formation of a new Specialty Cancer Centre at the NUH. This officially became the NCIS, the second designated national specialty cancer centre in Singapore in 2008. That same year, the Division of Oncology Nursing was formed.

MILESTONES THROUGH THE YEARS

Our clinical capabilities developed progressively over the years. Some significant milestones include the first bone marrow and kidney transplant done concurrently, and the first outpatient stem cell transplant for myeloma in Singapore.

Donation funds greatly spurred our research progress. In 2002, TCI was selected as one of the four beneficiaries of The Million Dollar Duck Race. In 2003, it was awarded the single largest grant amount to be presented by the Singapore Cancer Society for cancer research. In 2005, Adjunct Associate Professor Goh Boon Cher became the first from TCI to obtain the Clinician Scientist Award from the National Medical Research Council. To further expand our research capability, the Haematology Oncology Research Group (HORG) was established in 2010. Partnership with industries specialising in drug development and innovative clinical trials has continued to be a focus and is our research strength.

Patient support groups and other humanitarian causes further augmented our goals to serve the public. The first support group for breast cancer patients was established in 2001. We partnered with the International Cancer Expert Corps (ICEC) in 2014 to build global health alliances with a common goal to reduce mortality and improve the quality of life for people with cancer in low- and middle-income countries.

THE NCIS TODAY

Our facilities today are moulded with the satisfaction of patients in mind, boasting comprehensive facilities under one roof, occupying levels 8 to 10 of the new NUH Medical Centre. Our unique services provide help to everyone ranging from children to adults. The organisation now includes the Departments of Haematology-Oncology, Radiation Oncology, Division of Surgical Oncology and the Division of Oncology Nursing. We are pushing research frontiers with new treatments and the capability to personalise treatment for cancer patients.

PUSHING FORWARD

Moving forward, we will continue to focus on patient care and enhance our patients' treatment experiences by providing comprehensive and interlinked services as well as leveraging on cutting-edge research. In relation to these, we are developing the Division of

Professor John Wong (extreme right) receiving the $350,000 Terry Fox Run Research Grant in 2003

Psychosocial Oncology, which will have multiple touchpoints with patients while they receive treatment throughout their holistic cancer journey.

To further extend these initiatives beyond the hospital, we aim to create and engineer a regional cancer network that serves as a strong link to primary care and collaborations with other hospitals such as Ng Teng Fong General Hospital, Khoo Teck Puat Hospital and Tan Tock Seng Hospital, and in future, Woodlands General Hospital.

The next three to five years will definitely see an acceleration of our expansion and growth to build an NCIS not for us, and the here and now, but for the nation, and the future generations to come.

Official opening of the Cancer Centre at Level 8 of the NUH Kent Ridge Wing and Ward 56 in 2006

The NCIS celebrates the first World Cancer Day

Article by

Professor Chng Wee Joo

Director, National University Cancer Institute, Singapore (NCIS)

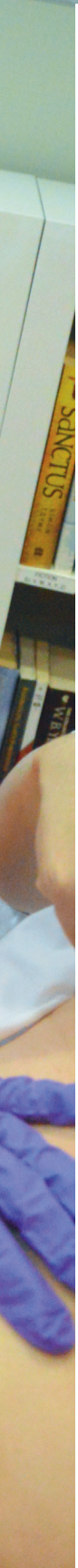
Senior Consultant, Department of Haematology-Oncology, NCIS

Prof Chng Wee Joo obtained his medical degree from the University of Leeds, UK, and did his internal medicine residency in the United Kingdom. He completed his fellowship training in haematology in Singapore before obtaining an A*STAR international fellowship in 2004, in which he did a research fellowship in multiple myeloma genetics at the Mayo Clinic. His current research is very translational and involves the use of high-resolution global genomic technique to understand biology, identify drug targets, understand drug resistance and improve disease prognosis in haematological malignancies, with the ultimate aim of improving our patients' outcome and personalising treatment. His specialty interests include lymphoma and multiple myeloma.

Home Care @ The NCIS:

The Care Continuum

A NCIS home care nurse administering VELCADE® therapy to a patient at his home



Ensuring patients' smooth transition from hospital stay to normal life at home is a key focus the National University Cancer Institute, Singapore (NCIS) has heavily invested in. As such, informal home care was established in 2001 by Professor John Wong and Zarinah Hairom, Assistant Director of Nursing, to provide home care for cancer patients. However, due to limited resources, it was only provided for special cases.

It was only in January 2014 that the first official home care team at the NCIS was set up, with the aid of government funding. This programme was then officially named the NCIS Transitional Care, also known as Caring Across Cancer Care (CA3C) P2, highlighting the continuity of cancer care from the point of diagnosis till end of life. Today, the team consists of three haematology- oncology trained nurses working alongside multi-disciplinary team members.

The services provided under this programme include post-cancer therapy symptom management, patient, family and caregiver education, psychosocial and spiritual support, medication reconciliation and administration, as well as referrals to community resources.

Feasibility and safety of the CA3C P2 programme were analysed based on 82 patients with different cancers, specifically: lymphoma (31.7%), colon cancer (14.6%) and lung cancer (9.8%). There were a total of 341 home visits conducted over a period of eight months, with no adverse events reported.

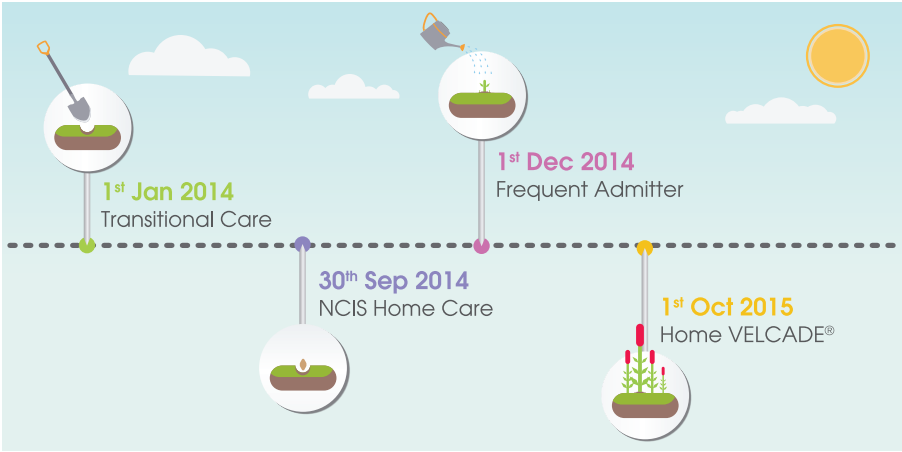
In December 2014, the government initiated a new model of care, the Frequent Admitter (FA) programme to fund home visits for patients with at least three hospitalisations over the past year, from the date of enrolment into the FA programme. With this new initiative, we were able to reach out to more patients, allowing them to benefit from home care services while reducing their unplanned readmissions to hospital. This has proven successful thus far, with a readmission rate of 28.7% since the start of the FA programme.

In August 2014, the NCIS Home Care – a dedicated home care programme applicable to all cancer patients – was officially launched. Similar to the CA3C P2 and FA programmes, this programme came with a fixed charge payable by patients, with services ranging from blood tests to post-chemotherapy coping. Since its launch, over 130 home visits have been made.

Moving forward, the NCIS Home Care Programme aims to provide disease-specific home care. One of the services includes administering VELCADE® (Bortezomib) in the comfort of myeloma patients' homes.

To supplement current home care services, we offer a free counselling hotline, CancerLine, managed by our trained oncology nurses. Our home care team also works closely with our haematologists and oncologists, medical social workers, nurse navigators, nurse counsellors and allied health professionals to provide our patients with an individualised and holistic care plan.

As the home care programme in the NCIS continues to evolve and expand, we aim to provide more bespoke treatment programmes while staying affordable. We believe that care goes beyond our patients' homes – the birthplace of love, hope and dreams – and we are glad to be a part of their lives.



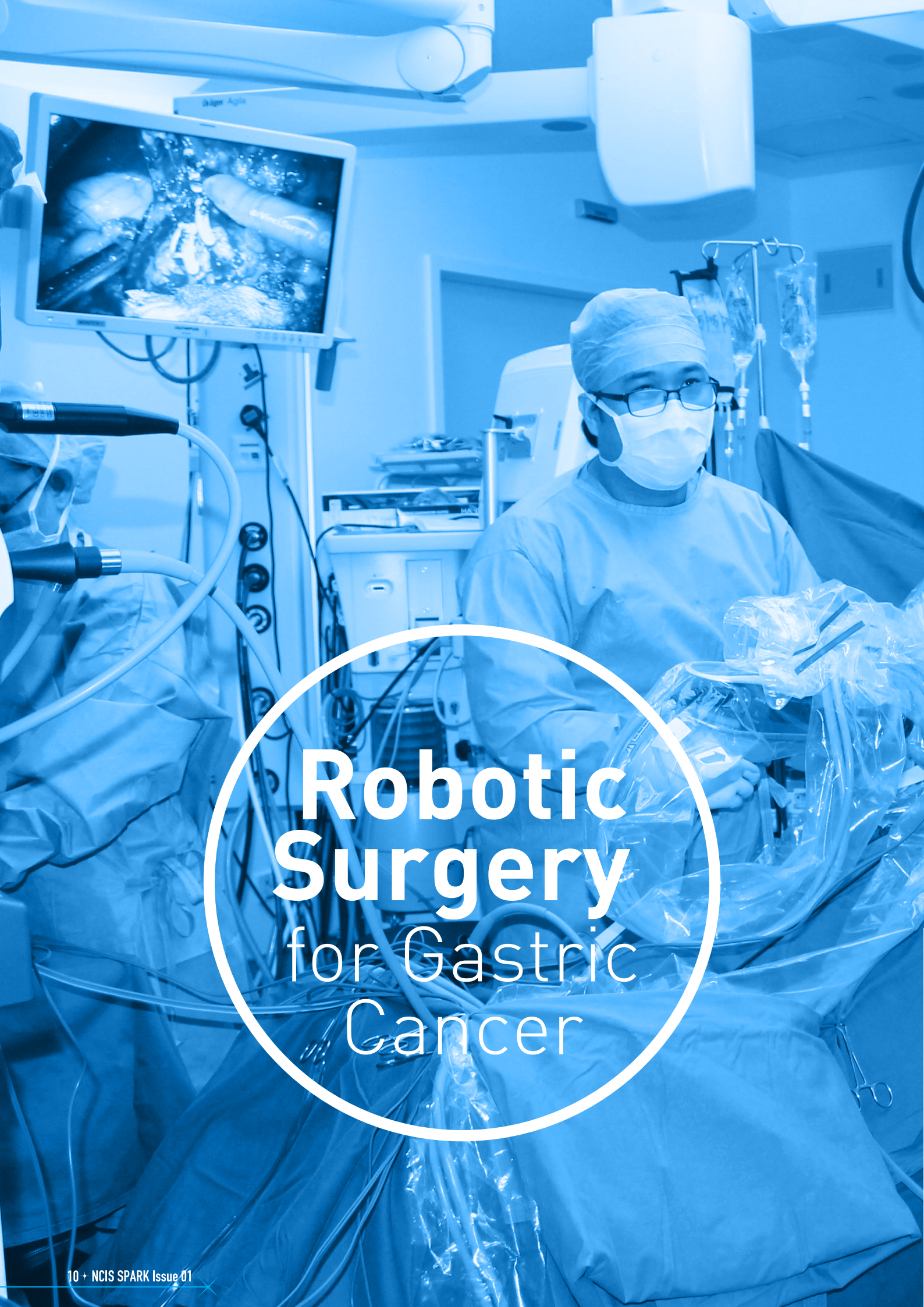
Milestones of the NCIS Home Care Programme

Article by

Dr Dora Lang
Nurse Clinician
Division of Oncology Nursing, NCIS

Kelly Lai
Senior Staff Nurse
Division of Oncology Nursing, NCIS

Dr Dora Lang completed her tertiary education and specialised diploma in oncology at Nanyang Polytechnic in 2000 and 2003 respectively. She obtained her basic nursing degree in La Trobe University in 2003. In 2012, she received her PhD with the Dean's commendation for Doctoral Thesis Excellence. She was awarded the Yong Siew Yoon Fellowship award from 2013-2016 to start home care services.



Robotic Surgery for Gastric Cancer

Patients with gastric cancer can now look forward to a more advanced method of surgery in the National University Cancer Institute, Singapore (NCIS), cutting down risks of infection and blood loss, as well as enhancing the speed of recovery.

Known as the Da Vinci surgical system, it is a robotic procedure relying on the precise movements of the robot including the jointed-wrist design and superior optical visualisation. The NCIS prides itself in being the pioneer of utilising this system, having successfully helped patients recover faster from gastric surgery.

In fact, gastric cancer is the seventh most common cancer in males and ninth most common cancer in females in Singapore[1]. However, patients can look forward to better treatments including advancements in surgery and newer chemotherapeutic methods, all of which increase patient survival rates.

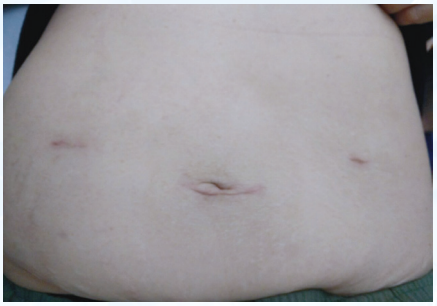


Figure 1: Post-surgery scars of a patient who has undergone the Da Vinci Surgery

Prior to the use of the Da Vinci surgical system, patients undergo major surgery which removes parts or all of the stomach and clears their lymph nodes through a 15-centimetre wound on the abdominal wall.

Hence, recovery is slow and the risks are significant due to wound complications. The introduction of the Da Vinci surgery system may greatly reduce these risks.

We hypothesise that a more thorough lymph node clearance with the Da Vinci system would possibly lead to better recovery outcomes for patients with gastric cancer due to its minimally-invasive approach, although long-term follow-up studies are still being conducted (Figure 1).

We are optimistic about the use of robotic surgery in the treatment of gastric cancer as results are promising. Clinical benefits in terms of reduced operative morbidity and improved oncological outcomes are discernible. This is a technology that the NCIS will embrace for the betterment of patient care.

ADVANTAGES OF ROBOTIC GASTRIC SURGERY

1. Better visualisation due to 3D images
2. Better ergonomics due to articulating instruments
3. Less hand tremor
4. Less surgical fatigue
5. Possible less complications

The main surgeon operating the Da Vinci system by remotely controlling the robotic arms

Reference:
1. Singapore Cancer Registry, Interim Report (Trends in Cancer Incidence in Singapore 2010-2014).

Article by

Associate Professor Jimmy So
Head & Senior Consultant
Division of Surgical Oncology, NCIS

Dr Ng Jun Jie
Senior Resident
University Surgical Cluster, National University Hospital

A/Prof Jimmy So received his surgical training at the National University Hospital, Singapore. He was trained in Upper Gastrointestinal Surgery, Surgical Oncology, Bariatric Surgery, Therapeutic Endoscopy and Minimally Invasive Surgery. He received fellowship training at the Massachusetts General Hospital, Harvard Medical School, USA. He was also appointed as visiting consultant surgeon in Esophageal and Gastric Surgery at the Royal Infirmary in Edinburgh, Scotland, UK. He received fellowship training in gastric and esophageal cancer surgery in Japan, Korea and Hong Kong. He is the pioneer in endoscopic surgery for early esophageal and gastric cancers, robotic surgery and Peroral Endoscopic Myotomy (POEM) for Achalasia in Singapore.

He has published many peer reviewed scientific papers and received multiple competitive grants for his research on these topics. Presently, he is actively involved in the management of patients with gastric and esophageal cancers, morbid obesity and other Upper GI disorders.

STEREOTACTIC ABLATIVE RADIOTHERAPY (SABR) PROGRAMME

Celebrating the 100th Patient

Bright New Hope for Cancer Patients

On 15 September 2015, the National University Cancer Institute, Singapore (NCIS) Radiation Therapy Centre treated its 100th SABR patient. From sending a team to undergo training at two renowned SABR centres in the US in 2011 and treating our 1st SABR patient in the same year, to treating our 100th SABR patient, it has indeed been a long journey in attaining this significant milestone.

Stereotactic Ablative Radiotherapy (SABR), previously known as stereotactic body radiation therapy (SBRT), is a newly-developed cancer treatment technology. Utilising specialised and highly advanced equipment, software and procedures, a tumour's location is precisely defined, its size and shape exactly mapped, and is precisely treated to high doses of radiation with minimal effect on surrounding, healthy tissues.

One of the immobilisation accessories

SABR differs from conventional radiotherapy primarily in achieving more accurate tumour delineation and precision of radiation delivery, which in turn allows higher doses to be delivered to the tumour. Expert radiation oncologists and their teams, who are specialised in the technique, use multiple, converging beam angles to safely deliver high-potency dosages. This reduces treatment time, spanning from just one to two weeks.

Currently at the NCIS, SABR is used in the treatment of tumours in the lungs and liver.

ADVANTAGES OF SABR

1. Treatment outcomes for eligible and properly selected patients are comparable to surgery, and certainly surpasses conventional external beam radiation therapy techniques.

2. Treatment duration is reduced to just one to five sessions, each lasting about 30 minutes. Total treatment duration, inclusive of preparation, is about two weeks – up to 80% reduction compared to conventional fractionation.

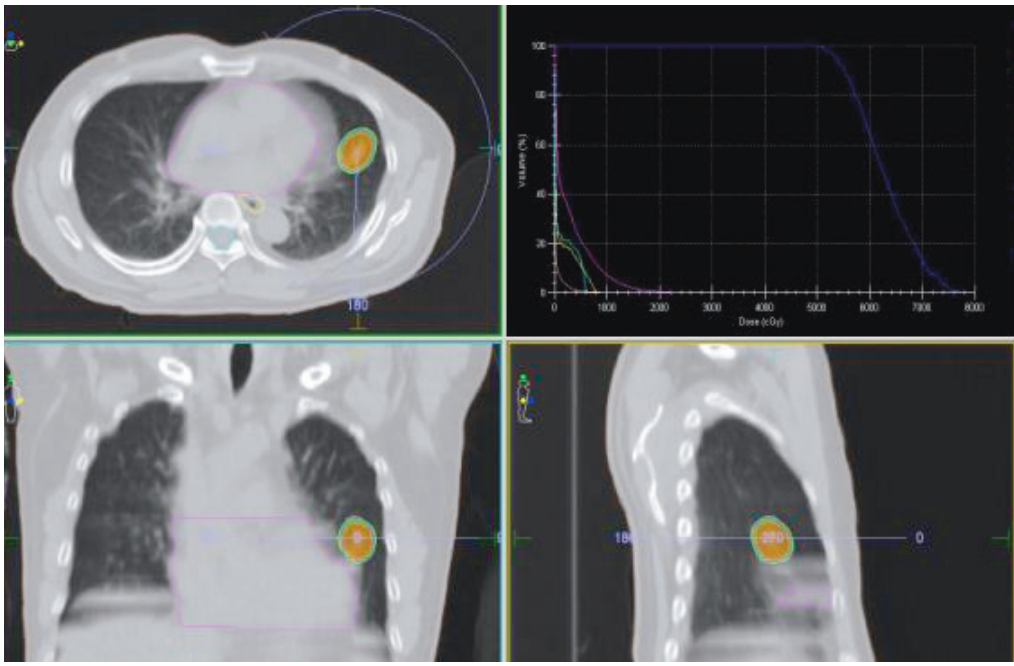
3. Side effects may be relatively mild or absent, depending on tumour location. Patients experience less lethargy, esophagitis, and risk of pneumonitis.

4. The overall cost of SABR is slightly higher than conventional treatment. However, for Singaporeans, a significant portion of the cost can be subsidised by Medisave and Medishield Life.

WHAT PATIENTS CAN EXPECT

1. The patient's history will be reviewed and his or her case will be evaluated for SABR eligibility.

2. The full procedure, including possible risks, discomforts and alternative treatment options, will be explained to the patient. After the patient has fully understood the procedure, written consent to proceed will be obtained.



Optimised treatment plan with high dose to the tumour and minimal dose to surrounding tissues

3. A 4D Computed Tomography (CT) simulation will be carried out. Once completed, small, permanent marks will be made on the patient's body. These will help in accurately positioning the patient at the time of treatment.

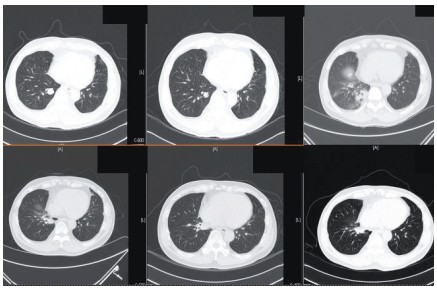
4. The patient's 4D CT images which take into consideration the patient's respiratory motion, will be imported to the planning software, where the tumour planning target volume (PTV) and the normal-tissue organs will be contoured. The dosimetrist will generate the optimum treatment plan. It will be reviewed and approved by the radiation oncologist.

5. During the treatment itself, a SABR radiation oncologist will be at the treatment console, utilising all available on-board imaging technologies to deliver the treatment in close accordance with the original treatment plan. They also take into account all potential patient-specific, tumour-specific, and organ-specific motion during treatments, in real time. The entire treatment takes about 30 minutes.

6. Once treatment is complete, the patient will be scheduled for routine follow-up consultations. The side effects of SABR are minimal as the treatment is very precise and accurate.

OUTCOME

Mr Tan, our 100th SABR patient, was a 75-year-old chronic smoker who was recently diagnosed with early stage lung cancer. He was deemed medically unfit for surgery. Before the availability of the SABR programme, he would have been offered conventional radiation therapy treatment which would result in inferior local control rates compared to surgery. Now, he has a three-year local control rate of 85-90% based on local NCIS SABR outcomes data, which is comparable to surgery.



Serial CT scans showing gradual resolution of the tumour after SABR

Article by

Dr Leong Cheng Nang

Clinical Director & Senior Consultant

Department of Radiation Oncology, NCIS

Assistant Professor

Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore

Dr Leong's interests are in stereotactic ablative radiotherapy (SABR), thoracic and gastrointestinal malignancy. He received his SABR training in the United States of America under the Ministry of Health Human Manpower Development Program (HMDP) in 2011. Upon his return, he set up the SABR programme at the NCIS. He also organises SABR symposiums and workshops to educate regional radiation oncologists on SABR.

Early Phase Clinical Trials

The NCIS Development Therapeutics Unit

HOW ARE CANCER DRUGS DEVELOPED FOR PATIENTS?

Drug development generally involves four Phases: Phase I, II, III and IV. The traditional scope of Phase I clinical trials are to evaluate safety and toxicity and to find out the optimal dose of novel agents or combinations of agents after appropriate pre-clinical testing of safety, toxicology and pharmacology in humans. In Phase II, up to several hundred people will be tested to see the effectiveness and side effects of the drug. Early Phase trials usually enrol patients with advanced disease who have limited or exhausted standard treatment options. Phase III sees people being tested for its efficacy in comparison with current available drugs. Phase IV takes place after licensing authorities' approval and further safety and efficacy evaluation will be carried out as patients start being treated with the new compound as a new standard of care.

WHY ARE EARLY PHASE TRIALS (PHASE I TRIALS) SO IMPORTANT?

A greater understanding of the biologic networks and pathways implicated in the development of cancer has led to the identification of many potentially "druggable" therapeutic targets and a corresponding increase in the number of compounds suitable for clinical investigation. Disappointingly, despite the rapid expansion of available drug candidates for early Phase testing, failures in translating the promise of these compounds to clinical reality remain prevalent[1,2]. In 2004, data accumulated from a whole host of industry sponsored Phase I trials between 1991-2000 showed that only less than 5% of cancer drugs tested in Phase I end up obtaining marketing authorisation[1]. Most experts are of the opinion that the shortcomings in cancer drug development come down to several factors: 1) at the pre-clinical Phase (i.e. laboratory development, pre-human testing Phase), many compounds were not properly assessed with the appropriate pre-clinical disease models and hence were subsequently found to be ineffective even at the optimal dosage; 2) the drugs were too toxic and should never have been developed in the first place; 3) the drugs did not actually have any proof of mechanism i.e. there was no evidence that the drug actually hit its intended molecular target in cancer cells; and 4) drugs went on to be developed in later Phase II and III studies despite the lack of demonstrable efficacy when the molecular target was "hit" in early Phase (Phase I) studies i.e. there was no early proof of concept.

Given the high costs associated with the conduct of later Phase trials, especially randomised Phase II or III trials, it is now, an increasingly common practice for many companies to discontinue development of their compounds if they cannot establish proof-of-mechanism by the end of Phase I testing. Therefore, in addition to assessing toxicity and tolerability, many Phase I trials have now assumed the role of "gate-keepers" in drug development, and are now an even more crucial first-step in the bench to bedside translational drug development process. Consequently, there is a growing consensus amongst cancer experts and the pharmaceutical industry that early Phase or Phase I clinical trials are now a fundamental component in the process of translating the pre-clinical data on the anti-cancer effects of a drug in the laboratory into real time clinical use for cancer patients.

A STATE-OF-THE-ART FACILITY FOR EARLY PHASE TRIALS: THE NCIS DEVELOPMENTAL THERAPEUTICS UNIT (DTU)

Since its inception, the NCIS has already developed a significant track record

and reputation for running early Phase studies in the region. The early Phase drug development unit has since gone from strength to strength and has further benefited from the formal establishment of our Developmental Therapeutics Unit (DTU) in 2014, supported administratively by the Haematology-Oncology Research Group (HORG), incorporating dedicated state-of-the-art inpatient and outpatient facilities for early Phase clinical trials aided by funding from the Yong Siew Yoon (YSY) NCIS grant. Given the lack of Asian patients recruited to Phase I trials, which are generally carried out in western countries, the NCIS recognised the need to establish a Phase I unit that would specifically address the question of identifying optimal drug doses in Asian patients.

THE NCIS DTU: A MULTI-DISCIPLINARY TEAM AT THE CUTTING EDGE OF CANCER CARE

The NCIS DTU comprises a team of clinicians, nurses, allied health professionals and scientists, who work in a multi-disciplinary team to ensure utmost standards of safety in conducting early Phase trials. The DTU team currently runs a dedicated clinic every Monday and Thursday and meet weekly to discuss the clinical progress of each DTU patient on studies and any other trial related issues. Through the YSY grant, we have also been able to develop a training fellowship programme in cancer drug development in the DTU. Our current fellow is Dr Valerie Heong who was working as a Consultant in medical oncology in Melbourne, Australia before deciding to take up the YSY fellowship in drug development at the NCIS last year. Importantly, the establishment of the NCIS DTU has already helped attract interest from drug companies seeking academic partners who have the appropriate infrastructure in place to support early Phase trials in Asia. This has in turn benefited our patients by giving them access to cutting-edge anti-cancer drugs. Currently ongoing clinical trials of novel compounds in the DTU are shown in Table 1.

The NCIS Developmental Therapeutics Unit (DTU) located at Ward 8A of the NUH

Table 1: DTU Phase I trials 2016

- P-TEFb inhibitor (Bayer)
- Trastuzumab + NK-cell therapy for HER2 amplified/overexpressed tumours
- Balanced PI3Kα/β inhibitor (Bayer)
- Exportin 1 (XPO1) inhibitor – selective inhibitor of nuclear export (Selinexor, Karyopharm)
- PDL-1 + MEK inhibitor (Roche)
- Pan-fibroblast growth factor receptor (FGFR) inhibitor (Bayer)
- AKT1 inhibitor (Astra Zeneca) in tumours with AKT1 mutations
- ASLAN001: HER1/2/4 inhibitor + carboplatin and paclitaxel
- PLK1 inhibitor (Tekmira)
- Wnt/Porc inhibitor (Experimental Therapeutics Centre/D3 A*STAR Singapore)

All of our medical oncologists in the team are also leading experts in specific tumour types (see Table 2) and hence provide added clinical and scientific insights into the management of each patient referred to the DTU.

Table 2: List of DTU Consultant Medical Oncologists

Consultant	Tumour subspecialty
Adj A/Prof Goh Boon Cher (Leader)	Head and Neck Cancers
Prof Chng Wee Joo	Haematological Cancers
Adj A/Prof Lee Soo Chin	Breast Cancer and Cancer Genetics
Dr Chee Cheng Ean	Gastrointestinal Cancers
Dr Ross Soo	Lung Cancers
Dr David Tan	Gynaecological Cancers
Dr Andrea Wong	Breast and Central Nervous System Cancers
Dr Yong Wei Peng	Gastrointestinal Cancers

Given that many of the currently tested compounds target a specific molecular pathway aberration in cancer cells, patients in our DTU early Phase trials are also offered molecular profiling of their tumours via our integrated molecular analysis of cancer (IMAC) programme to identify these "actionable" molecular aberrations in the tumour cells so that, based on their tumour molecular profile, patients can be matched to the most appropriate drug in early Phase clinical trials.

FINDING AND DEVELOPING THE NEXT GENERATION OF ANTI-CANCER DRUGS

The next era of oncological therapy will inevitably evolve from a better understanding of the molecular aberrations in cancers allied with technologies that will facilitate a rapid and comprehensive characterisation of the unique biological features of each cancer patient's tumour. The challenge for oncologists is to leverage on this wealth of scientific information to develop more effective therapeutic options for patients via well-designed and expertly executed early Phase studies. The NCIS DTU is now fully equipped to embrace this challenge and lead the development of new drugs in the fight against cancer.

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1. Kola I, Landis J. Can the pharmaceutical industry reduce attrition rates? Nat Rev Drug Discov 2004; 3: 711-715.
2. Kurzrock R, Benjamin RS. Risks and benefits of Phase I oncology trials, revisited. N Engl J Med 2005; 352: 930-932.
3. Loong HH, Siu LL. Selecting the best drugs for Phase I clinical development and beyond. Am Soc Clin Oncol Educ Book 2013; 469-473.

Article by
Dr David Tan
Consultant
Department of Haematology-Oncology, NCIS

Dr David Tan is a consultant medical oncologist and clinician scientist at the NCIS. He is also an Assistant Professor at the Yong Loo Lin School of Medicine, NUS. Dr Tan graduated with an intercalated BSc in Experimental Pathology and MBBS with Distinction from Guy's, King's and St Thomas' School of Medicine, University of London. He undertook training in internal medicine at Hammersmith, Guy's and St Thomas' Hospitals in London, and obtained his MRCP(UK) in 2005. He was a Cancer Research UK Clinical Research Fellow at the Institute of Cancer Research, London, where he obtained his PhD, and trained in Medical Oncology at the Royal Marsden Hospital, London. He also completed a fellowship in Drug Development and Gynaecologic Oncology at the Princess Margaret Cancer Centre, University of Toronto before returning to Singapore.

Members of the Haematology-Oncology Research Group (HORG)

CELLULAR IMMUNOTHERAPY

RATIONALE FOR CELLULAR IMMUNOTHERAPY

A long-standing goal for oncologists has been to exploit the power and specificity of the immune system to fight cancer. Decades of laboratory and translational research have pointed to many promising ways to achieve this goal. Among these, infusion of immune cells with boosted activity (i.e. cellular immunotherapy) has recently produced spectacular clinical results, raising enormous interest in this field.

One of the first clear indications that immune cells could have an anti-cancer effect came from the experience with bone marrow transplantation in patients with leukaemia. During this procedure, patients receive blood stem cells from a healthy donor to restore their own blood cells, wiped out by high-dose chemotherapy and/or radiotherapy given to eradicate leukaemic cells. A side-effect is graft-versus-host disease (GvHD), caused by the donor's immune cells present in the graft attacking tissues and organs of the patient.
Haematologists noted that patients with more severe GvHD appeared to have a better chance of remaining in remission after transplant. This observation suggested that cells responsible for GvHD, called T lymphocytes, could also have an anti-leukaemia effect, leading to the practice of infusing donor T lymphocytes after transplant to suppress leukaemia relapse. This infusion can produce dramatic leukaemia regression in some patients, demonstrating that T lymphocytes can succeed even when intensive chemotherapy and radiotherapy have failed. Unfortunately, donor lymphocyte infusion also has the potential of causing deadly GvHD, and it is therefore used only as a last-ditch treatment.

DIRECTING T LYMPHOCYTES AGAINST CANCER CELLS

Can the risk of GvHD after T lymphocyte infusions be averted? If so, can these "living drugs" be exploited even outside the bone marrow transplantation context?

In the late 80s to early 90s, Dr Zelig Eshhar and his colleagues were studying the molecular mechanisms underlying T lymphocyte function. To this end, they coaxed T lymphocytes to express on the cell surface a chimeric receptor, i.e. an artificial protein made of several components, that could trigger cell activation at will. Not only did the method work, but the scientists soon realised that their receptor (now known as "chimeric antigen receptor" or CAR) could be designed to direct T lymphocytes against cancer cells. By using the patient's own engineered T lymphocytes instead of those of a donor, GvHD could be averted.

Often in science, truly innovative ideas are not immediately embraced; Eshhar's method was no exception. Nevertheless, some laboratories, including ours, appreciated its potential. Initial experiments confirmed the extraordinary capacity of CAR-T lymphocytes to kill tumour cells but suggested that the original receptor was incomplete and that improvements were needed to fully activate T lymphocytes. Thus, new stimulatory molecules were incorporated into the CAR structure to boost T lymphocyte growth and survival, generating what is now called "second generation CAR". The use of second generation CAR-T lymphocytes directed against CD19, a molecule expressed by cells in many forms of leukaemia and lymphoma, resulted in dramatic clinical responses, providing startling evidence supporting this technology. We are working towards bringing this technology to the NCIS.

NATURAL KILLER (NK) CELLS: ANOTHER IMMUNE CELL TYPE WITH ANTI-CANCER POTENTIAL

Besides T lymphocytes, other immune cells can have anti-cancer activity. The main function of NK cells, a small fraction of blood lymphocytes, is to eliminate cells infected by viruses, thus preventing virus spreading. NK cells have a set of inhibitory and activating receptors that bind molecules ("ligands") on the surface of other cells. When a cell becomes infected by a virus, some of the ligands for inhibitory NK receptor decrease while ligands for activating receptors increase. The net balance of external signals tells the NK cell whether the other cell must be killed or not.

The use of NK cells for cancer therapy stems from the idea that this sophisticated system of receptor-ligand interactions can also work against cancer cells. Indeed, infusion of NK cells from healthy donors (contrary to T lymphocytes, NK cells do not cause GvHD) have produced impressive clinical responses in some patients with acute myeloid leukaemia. However, tumour cells often lack sufficient activation ligands or express inhibitory ligands which nullify the stimulation from their activating counterparts.

To use NK cells to treat cancer, we must solve two main problems: 1) get them in sufficient numbers, and 2) tilt the receptor balance in favour of activation, so that cancer cells can be recognised as the ones to eliminate. Research in our laboratory has found ways to obtain nearly infinite numbers of NK cells. We have also designed new receptors, including CARs; when expressed by the NK cells, these receptors can markedly increase NK cell capacity to recognise tumour cells and kill them. These efforts have resulted in several clinical trials currently open at the NCIS. In NKEXPSIN, we use donor NK cells to treat children and adults with acute myeloid leukaemia and T-cell acute lymphoblastic leukaemia. In NKEXPSARC, we use a similar NK cell product for patients with sarcoma. In NKCARCD19, we use expanded donor NK cells engineered to express an anti-CD19 CAR to treat patients with acute lymphoblastic leukaemia.

USING IMMUNE CELLS TO INCREASE THE ANTI-TUMOUR ACTIVITY OF ANTIBODIES

Antibodies are part of our immune response against infections but can also be made in the laboratory against molecules expressed by cancer cells. Antibodies are shaped like a "Y": the arms of the "Y" latch onto the surface of a cancer cell while the stalk of the "Y" can trigger mechanisms which ultimately lead to the cancer cell's demise. Antibodies are now part of standard treatment for many types of cancer. For example, Rituximab is routinely used to treat patients with B-cell lymphoma, and Trastuzumab to treat patients with breast cancer.

Among the anti-cancer mechanisms triggered by antibodies, perhaps the most important is the recruitment of NK cells, which have a special receptor called CD16, capable of binding the

stalk of the antibody. Thus, NK cells become activated and proceed to kill the cell targeted by the antibody. One way to increase antibody activity is to infuse a fresh supply of activated NK cells. This strategy is used in our NKEXPHER clinical study for patients with breast or gastric cancer, where the patient's own NK cells are activated and infused together with the antibody Trastuzumab. In NKEXPHNC, a similar procedure is performed for patients with head and neck cancer, using the antibody Cetuximab instead.

Another way to increase antibody activity requires genetic engineering of T lymphocytes. These cells do not normally express CD16 and therefore cannot be activated by antibodies. In our laboratory, we developed a receptor that carries the CD16 molecule; when expressed in T lymphocytes, these can act like NK cells and kill target cells bearing the antibody. T-cells stimulated via this receptor also increase in numbers, thus further enhancing their anti-tumour effect. Our ATTCK20 clinical study for patients with B-cell non-Hodgkin lymphoma or chronic lymphocytic leukaemia uses the patient's T-cells, engineered to express CD16, together with the antibody Rituximab.

TRANSLATING LABORATORY RESEARCH INTO THERAPIES

Preparing cell products for infusion in patients, as we are currently doing at the NCIS, is a complex procedure. The number of cells required in the clinic is at least 100-fold greater than that used in a standard laboratory experiment, and much expertise is required to translate a research method into a clinical-grade protocol. Clinical-grade cell manipulation must be performed in a purposely built laboratory, using materials and procedures that meet international standards referred to as "current Good Manufacturing Practices (or cGMP)". In Singapore, this process is regulated and monitored by the Health Science Authority.

The preparation of engineered T-cells and NK cells for immunotherapy typically consists of collecting blood from patients or healthy donors (usually family members) via leukapheresis, a procedure similar to that of a platelet donation which extracts only the needed cells from the blood, giving back the rest (Figure 1). This is followed by cell culture for activation and expansion according to cGMP, lasting about 10 days. During this time, cells may be exposed to genes encoding CARs or other receptors, together with genes of viral origin which facilitate entry into the cell and ensure permanent gene expression. At the completion of the culture, cells are concentrated and infused. Before infusion, the patient may receive chemotherapy which will deplete the existing T lymphocytes and make space for the infused ones. Another way to modify cells consists of expanding them as above but inserting the gene of interest at the end of the culture by a method called electroporation, in which cells are exposed to electric pulses which open and close tiny pores on the surface of the cells. With this method, the gene expression is transient and persists for only a week or so.

As described in this article and summarised in Figure 2, many of our research advances have already been translated into clinical studies at the NCIS. The main objective of these studies, which are not available anywhere else, is to determine the feasibility of the immune cell manipulation in a clinical setting, and assess the potential adverse events associated with the cells' infusion. Of course, the underlying hope is that these cellular immunotherapies will result in tumour responses and clinical improvements.

These clinical trials could be executed because of the strong and diverse expertise of NCIS physicians, the solid NCIS clinical trial infrastructure, and the generous financial support of our philanthropic donors. Moving forward, we are well-positioned to learn from this experience and further advance this exciting area of cancer research, with the hope of helping as many patients as possible in the process.

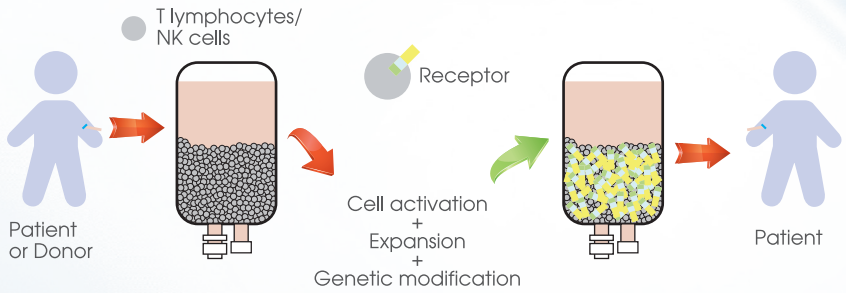


Figure 1. Preparation of engineered immune cells (T lymphocytes or NK cells) for clinical use. Peripheral blood is obtained from the patient or a donor by leukapheresis. Cells are then activated, expanded and, if necessary, genetically modified, under cGMP conditions before infusion. Patients often receive chemotherapy while waiting for the cells, which will facilitate their engraftment.

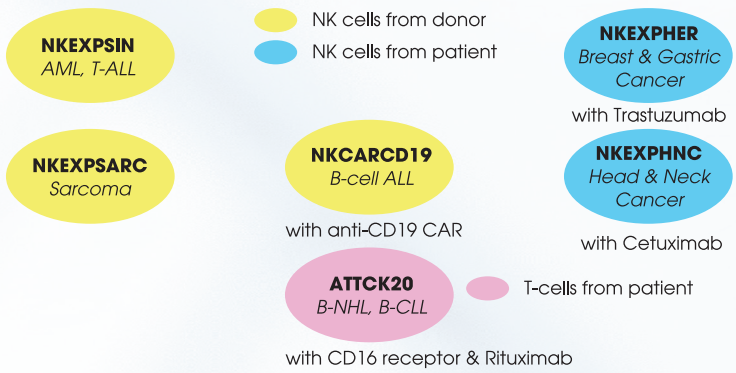


Figure 2. Cellular immunotherapy clinical trials currently open at the NCIS

Article by

Professor Dario Campana

Department of Paediatrics,
Yong Loo Lin School of Medicine,
National University of Singapore

Prof Campana obtained his MD and PhD degrees in Italy, where he received his clinical training in haematology. He trained as a scientist at the Royal Free Hospital, University of London, before moving to St. Jude Children's Research Hospital in Memphis, where he was a Full Member in the Departments of Oncology and Pathology, and Professor of Paediatrics at the University of Tennessee. He is currently Professor in the Department of Paediatrics, Yong Loo Lin School of Medicine, National University of Singapore. He holds the Mrs. Lee Kong Chian Chair in Advanced Cellular Therapy, and is a recipient of a Singapore Translational Research Investigator award. Prof Campana's main interest is translational research in oncology, focusing on monitoring response to treatment in leukaemia, and immunotherapy of leukaemia and solid tumours.

Key speakers of the NCIS Annual Research Meeting 2015

THE NCIS Annual Research Meeting 2015

Harnessing Immunotherapy in Cancer Treatment

The 2nd National University Cancer Institute, Singapore (NCIS) Annual Research Meeting (NCAM 2015) was held on 3 July. With the theme, "Harnessing Immunotherapy in Cancer Treatment", the meeting aimed to promote research culture, nurture junior clinician investigators and foster interactions between clinicians, clinician-researchers and basic researchers by providing clinicians and scientists with a platform to interact and showcase their cancer research work on the NCIS campus.

Professor John Eu-Li Wong, Chief Executive, National University Health System (NUHS) and Senior Consultant, Department of Haematology-Oncology, NCIS, officially launched the meeting with an enlightening welcome address. Members of the NCAM's scientific committee chaired the day's programmes, which included educational sessions, oral and poster presentations of cancer research abstracts as well as an awards presentation to recognise the best submissions. In 2015, over 120 abstracts were submitted in four categories – basic science, clinical science, nursing/paramedical/supportive care and translational science.

Over 200 participants attended the event, including internal delegates from the NUHS, NCIS, Cancer Science Institute (CSI), NUS Yong Loo Lin School of Medicine and Saw Swee Hock School of Public Health. External delegates from the National Cancer Centre Singapore (NCCS), Institute of Molecular and Cell Biology (IMCB) and A*STAR were also present.

Adj A/Prof Goh Boon Cher presenting on immunotherapy development in solid tumours

During the plenary session, Professor Anthony Chan, overseas delegate from the Chinese University of Hong Kong, gave an insightful talk on novel treatment strategies in nasopharyngeal carcinoma and the potential role of immunotherapy while the NCIS's very own Adjunct Associate Professor Goh Boon Cher gave a progressive perspective on immunotherapy development in solid tumours and a foresight of upcoming developments in Asia.

Staff from the NCIS who were part of the NCAM 2015 Organising Committee

Overall, the event was a huge success and we look forward to hosting more cross-collaborative opportunities for cancer research.

A session of empowerment for the participants of the Breast Cancer Public Forum

Over 40 participants attended the event and some of our breast cancer survivors graciously shared their experiences with the disease through poignant sharing sessions. Participants also watched 'Cancer Hair', a thought-provoking short film about a young woman's self-discovery throughout her journey with cancer, which was screened for the first time in Singapore.

After the forum, participants also visited booths set up by supporting partners, including Niks Professional, Can-care, Vitagen and the Singapore Cancer Society's "Look Good Feel Better" team.

Breast Cancer Public Forum: **Cancer Hair & Skin**

Empowering Confidence in Patients

A participant commented, "The event was very successful. Thanks for all the care and concern for all cancer patients."

In conjunction with Breast Cancer Awareness Month 2015, the National University Cancer Institute, Singapore (NCIS) organised a Breast Cancer Public Forum in support of our breast cancer patients.

Entitled "Cancer Hair & Skin", the forum aimed to empower breast cancer patients by organising interactive make-up and scarf demonstrations. These gave them knowledge on how to cope with breast cancer and treatment, such as hair and skin changes during cancer therapy, and encouraged them to look and feel beautiful despite their illness.

Dr Chan Ching Wan, Senior Consultant, Division of Surgical Oncology (Breast Surgery), NCIS, delivered the welcome address. Dr Lim Siew Eng, Associate Director (Clinical – Education) and Senior Consultant, Department of Haematology-Oncology, NCIS, and Ms Linda Ho, Niks Professional, shared on topics related to breast cancer.

One of the participants getting a hands-on make-up demonstration by Ms Linda Ho of Niks Professional

Multi-disciplinary panel of speakers during the Q&A session

Winning Against **Cancer Symposium 2015**

All You Need To Know About Women's Cancers

The feedback from participants were positive and encouraging, which further propels the NCIS to relive the success for next year's Winning Against Cancer Symposium.

On 15 August, the National University Cancer Institute, Singapore (NCIS) held another edition of Winning Against Cancer Symposium 2015 at the National University Health System (NUHS) Tower Block Auditorium. With the theme, "All You Need To Know About Women's Cancers", the symposium aimed to raise awareness and educate the public on Women's Cancers. This year, the spotlight was on breast and womb cancer, two out of the top 10 cancers to afflict Singaporean women.

Over 200 participants attended the symposium and gained valuable insights on the disease. A panel of multi-disciplinary speakers also discussed on recent clinical breakthroughs and treatment approaches. Both sessions wrapped up with a lively and informative Q&A session.

After the sessions, participants also had the opportunity to engage in various activities presented by our sponsors and partners such as the Singapore Cancer Society, Brands, Vitagen and Made Real, amongst others.

Representatives of The Singapore Cancer Society, one of the key supporting partners of the event

Inaugural World Lymphoma **Awareness Day 2015**

Gaining K(node)ledge, Understanding Lymphoma

According to the Singapore Cancer Registry, over 3,400 Singaporeans were afflicted with lymphoma between 2010-2014. During the same period, the disease was the 5th and 6th most commonly occurring cancer in Singaporean men and women respectively.

To raise awareness of the disease, Singapore's Inaugural World Lymphoma Awareness Day Symposium 2015 was held on 26 September at the National University Health System (NUHS) Tower Block Auditorium. The event was organised by the National University Cancer Institute, Singapore, in collaboration with the National University Hospital (NUH), National Cancer Centre Singapore (NCCS), Singapore General Hospital (SGH), Leukemia and Lymphoma Foundation (LLF), and Singapore Cancer Society (SCS).

The multi-lingual symposium, comprising English, Mandarin and Malay sessions, aimed to educate and empower the audience through experts sharing knowledge of lymphoma. Led by a team of multi-disciplinary speakers from partner institutions, topics such as the risks of getting the disease, its signs and symptoms, and treatment options were explored. Dietitians also provided nutritional talks alongside inspirational anecdotes by survivors.

Through such public education initiatives, we aim to empower the public with knowledge on cancer awareness so as to promote early screening and detection, translating to early diagnosis and treatment, thus enabling a better chance of recovery for patients.

The event was attended by close to 150 participants who also partook in light-hearted activities.

Multi-institutional panel of speakers during the Q&A session

A participant shared, "Many thanks for the event today. It was really great and well-organised. The content was very useful."

The NCIS Celebrates Life Survivorship Party 2015: **Carnival of Hope**

Celebrating Life Beyond Cancer

The NCIS held our annual The NCIS Celebrates Life Survivorship Party 2015 on 21 November. With the theme, "Carnival of Hope", patients, survivors and their caregivers across all our support groups gathered to celebrate life beyond cancer through interactive and engaging workshops that feature holistic activities.

The activities include mindfulness therapy, crochet, upcycling, magazine handicraft and yin yoga workshops with the aim of encouraging participants to engage in meaningful activities despite their battle with cancer. Four of our cancer warriors also gave motivational speeches.

On a lighter side, participants also got involved in other activities such as caricature, name calligraphy and roving photography.

Both empowering and entertaining, the event received much rave and enthusiastic feedback.

"Thank you for inviting us to the NCIS event. It was very well-organised. We enjoyed ourselves tremendously and got to meet fellow survivors and made new friends." – Mdm Chan

Cancer survivors of the NCIS and their jubilant celebration of life

GET FIT @ 50!

Colorectal Cancer Prevention, it's a Matter of Choice.

Mr Teo Kee Huat, 72, is a sports enthusiast who jogs, swims and also plays basketball regularly. Every Sunday, he will wake up at 5.00am without fail to join his jogging and brisk-walking "kakis" for a walk from Bukit Merah to Sentosa. However, not many people are aware that behind his sporty outlook, he is a colorectal cancer survivor with a stoma attached to his intestine. In 2009, he was diagnosed with colorectal cancer after finding traces of blood in his stool. After his surgery, he joined the Singapore Cancer Society support group and is now volunteering to reach out to help newly diagnosed colorectal cancer patients.

Colorectal cancer is currently the top cancer in Singapore (first in males and second in females). Alongside an ageing population, it is predicted that the incidence rate will continue to climb in the future. Some contributing factors towards colorectal cancer include a sedentary lifestyle, obesity, tobacco smoking and high intake of red meat and processed meat.

Unknown to many, colorectal cancer is highly preventable through screening.

Most colorectal cancers develop slowly over several years and usually start as benign polyps that grow from the mucosa in the colon. These polyps should be removed before they turn cancerous. Some of the common signs and symptoms of colorectal cancer include blood and mucus in stool or persistent abdominal discomfort. The risk of developing colorectal cancer increases as one passes the age of 50. Hence, screening for the disease should begin at age 50 to improve treatment outcome and cure rate.

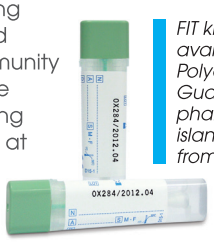
"One of the best ways to prevent cancer is through early detection and regular checks annually. Everyone can take charge of their health by adopting a healthier lifestyle and participating in screening programmes," said Dr Chee Cheng Ean, Chair of the Singapore Cancer Society Colorectal Cancer Awareness Campaign 2016 and Consultant, Department of Haemotology-Oncology at the National University Cancer Institute, Singapore (NCIS), who treats patients diagnosed with colorectal cancer.

As part of the Singapore Cancer Society's mission to educate and prevent cancer amongst Singaporeans, it will launch the 15th Colorectal Cancer Awareness Campaign in March 2016. Citizens and Permanent Residents (PR) will be able to collect the Faecal Immunochemical Test (FIT) kits at no charge. The FIT kit tests for blood in the stool which could be a symptom of colorectal cancer.

BENEFITS OF THE FIT:

- It is a non-invasive screening test for colorectal cancer.
- It is a preliminary screening to specifically detect human blood in a person's stool sample, without any diet restrictions or requirements.
- It is a safe, easy to do test which you can do in the privacy of your home.
- It is free for you to collect the kit and get yourself tested if you are 50 years old and above, Singaporean or PR.

The free FIT kits will be available for collection by members of the public at Polyclinics and Guardian pharmacies island-wide from March 2016 onwards. For more details on the specific outlets and collection of the kits, please visit the SCS website (www.singaporecancersociety.org.sg). During the campaign period, the SCS will also be running public awareness roadshows and tie-ups with corporate and community partners to raise awareness of the disease. The SCS will also be setting up booths to distribute the FIT kits at the NCIS and NUH during the campaign period.



FIT kits will be available at Polyclinics and Guardian pharmacies island-wide from March 2016

For more information, visit the SCS website or Facebook (facebook.com/sgcancersociety) or email **cancerscreening@singaporecancersociety.org.sg / education@singaporecancersociety.org.sg.**

Nurse Manager Ms Keren Heng (left) and Nurse Clinician Dr Dora Lang at the National Day Awards 2015

National Day Awards 2015

NCIS Nurses clinch the Efficiency Medal

The Singapore National Day Awards recognise individuals who have made significant contributions to public service, rendering various forms of merit and service to Singapore.

In conjunction with Singapore's 50th year of independence, the 2015 awards particularly recognised the hard work and dedication of our nation's pioneers and those who have made outstanding contributions to nation-building.

In 2015, two NCIS nurses – Nurse Clinician Dr Dora Lang Siew Ping, and Nurse Manager Ms Keren Heng Kea Ling, Division of Oncology Nursing – each received the Efficiency Medal. Inaugurated in 1969, the medal is awarded to certain individuals (e.g. public officers and education officers) for exceptional efficiency or devotion to duty or for work of special significance.

With regards to receiving the award, Dr Lang said, "A culture of belief and trust within the nursing division at the NCIS is the key to winning the award. Special thanks to Senior Nurse Manager (SNM) Ong Hwee Sen and SNM Clarice Tan for nominating me for the award."

Sister Heng also shared, "I thank God, my family, peers, supervisors, colleagues, staff and all my friends. Their support and help over the years have helped me to grow and become the nurse that I am today. I am honoured to receive the award."

This is not the first time NCIS staff received this accolade; Nurse Clinician Belinda Tan and Nurse Clinician Sharmila d/o Kasinathan were awarded in 2011 and 2014 respectively.

The NCIS is proud of all the winners and congratulate them for earning this prestige.

Specialist and Tumour Group Listing

Blood Cancers and Blood Disorders

Bone Marrow and Stem Cell Transplant Programme

Haematology-Oncology
Dr Koh Liang Piu (Leader)
Dr Poon Li Mei Michelle
Dr Tan Lip Kun

Radiation Oncology
Dr Tham Weng Keong Ivan
Dr Balamurugan A Vellayappan

Diagnostic Imaging
Dr Khor Lih Kin
Dr Loi Hoi Yin

Coagulation

Haematology-Oncology
Dr Liu Te Chih (Leader)
Dr Lee Shir Ying
Dr Yap Eng Soo

General Haematology

Haematology-Oncology
Dr Liu Te Chih (Leader)
Dr Lee Shir Ying
Dr Ng Chin Hin
Dr Tung Moon Ley

Leukaemia, Myelodysplastic and Myeloproliferative Neoplasms (MDS/MPN)

Haematology-Oncology
Dr Ng Chin Hin (Leader)
Dr Chan Hian Li Esther
Dr Koh Liang Piu
Dr Ooi Gaik Ming Melissa
Dr Tan Lip Kun
Dr Tung Moon Ley

Radiation Oncology
Dr Tham Weng Keong Ivan
Dr Balamurugan A Vellayappan

Diagnostic Imaging
Dr Khor Lih Kin
Dr Loi Hoi Yin

Lymphoma

Haematology-Oncology
Dr Poon Li Mei Michelle (Leader)
Dr Chan Hian Li Esther
Dr Sanjay De Mel
Dr Tan Lip Kun

Radiation Oncology
Dr Tham Weng Keong Ivan
Dr Balamurugan A Vellayappan

Diagnostic Imaging
Dr Arvind Kumar Sinha
Dr Khor Lih Kin
Dr Loi Hoi Yin

Multiple Myeloma

Haematology-Oncology
Prof Chng Wee Joo (Leader)
Dr Sanjay De Mel
Dr Ooi Gaik Ming Melissa

Radiation Oncology
Dr Tham Weng Keong Ivan
Dr Balamurugan A Vellayappan

Diagnostic Imaging
Dr Arvind Kumar Sinha
Dr Khor Lih Kin
Dr Loi Hoi Yin

Breast Cancer

Surgical Oncology
Dr Chan Ching Wan (Leader)
A/Prof Mikael Bo Anders Hartman
A/Prof Philip Iau Tsau Choong
Dr Shaik Ahmad Bin Syed Buhari
Dr Tang Siau-Wei

Diagnostic Imaging
A/Prof Quek Swee Tian
Dr Pooja Jagmohan
Dr Jeevesh Kapur
Dr Henry Oscar
Dr Premilla Pillay
Dr Felicity Pool

Pathology
A/Prof Thomas Choudary Putti

Haematology-Oncology
Prof John Wong Eu-Li
Adj A/Prof Lee Soo Chin
Dr Lim Siew Eng
Dr Lim Yi Wan
Dr Tan Sing Huang
Dr Andrea Wong Li Ann

Radiation Oncology
Dr Choo Bok Ai
Dr Koh Wee Yao
Dr Johann Tang I-Hsiung
Dr Balamurugan A Vellayappan

Plastic, Reconstructive & Aesthetic Surgery
Dr Jane Lim
Dr Ong Wei Chen
Dr Yap Yan Lin

Colorectal Cancer

Surgical Oncology
Dr Cheong Wai Kit (Leader)
Dr Chong Choon Seng
Dr Ridzuan Farouk
Dr Sharon Koh Zhiling

Dr Lee Kuok Chung
Dr Bettina Lieske
Dr Frances Lim Sheau Huei
Dr Tan Ker Kan

Haematology-Oncology
Dr Chee Cheng Ean
Dr Thomas Soh I Peng
Dr Yong Wei Peng

Radiation Oncology
Dr Leong Cheng Nang
Dr Jeremy Tey Chee Seong

Diagnostic Imaging
Dr Bertrand Ang Wei Leng
Dr Lynette Teo Li San
Dr Thian Yee Liang

Gastroenterology & Hepatology
Dr David Ong Eng Hui

Pathology
Prof Teh Ming
Dr Brendan Pang Nhgee Kheem

Gynaecologic Cancer

Gynaecologic Oncology
A/Prof Jeffrey Low Jen Hui (Leader)
A/Prof Arunachalam Ilancheran
Dr Ida Ismail-Pratt
Dr Joseph Ng Soon Yau
Dr Pearl Tong

Diagnostic Imaging
Dr Bertrand Ang Wei Leng
Dr Wynne Chua Yuru
Dr Pooja Jagmohan
Dr Khor Lih Kin
Dr Ong Ching Ching
Dr Thian Yee Liang

Pathology
A/Prof Raju Gangaraju Changal
Dr Qasim Ahmed
Dr Diana Lim Gkeok Stzuan

Haematology-Oncology
Dr Lim Siew Eng
Dr Lim Yi Wan
Dr David Tan Shao Peng

Radiation Oncology
Dr Choo Bok Ai
Dr Vicky Koh
Dr Johann Tang I-Hsiung

Head & Neck Cancer

Surgical Oncology
A/Prof Thomas Loh Kwok Seng (Leader)
Dr Lim Chwee Ming
Dr Jane Lim
Dr Tan Wee Boon

Diagnostic Imaging
Prof Vincent Chong Fook Hin
Dr Choong Chih Ching
Dr Tan Ai Peng
Dr Eric Ting
Dr Jocelyn Wong Yen Ling

Pathology
A/Prof Fredrik Bengt Petersson

Haematology-Oncology
Adj A/Prof Goh Boon Cher
Dr Tan Chee Seng

Radiation Oncology
Dr Timothy Cheo
Dr Francis Ho
Dr Tham Weng Keong Ivan
Dr Wong Lea Choung

Thyroid Cancer

Surgical Oncology
A/Prof Thomas Loh Kwok Seng (Leader)
A/Prof Thirugnanam Agasthian
Dr Lim Chwee Ming
Dr Frances Lim
Dr Ngiam Kee Yuan
Dr Rajeev Parameswaran
Dr Tan Wee Boon

Endocrinology
E/Prof Lim Pin
Dr Chionh Siok Bee
Dr Doddabele S Deepak
Dr Kao Shih Ling
Dr Eric Khoo Yin Hao
Dr Soh Lip Min
Dr Samantha Yang

Diagnostic Imaging
Dr Arvind Kumar Sinha
Dr Khor Lih Kin

Pathology
A/Prof Nga Min En
A/Prof Fredrik Bengt Petersson
Dr Qasim Ahmed

Haematology-Oncology
Adj A/Prof Goh Boon Cher

Liver, Pancreatic and Bilary (HPB) Cancer

Surgical Oncology
A/Prof Stephen Chang Kin Yong (Leader)
Prof Krishnakumar Madhavan
Dr Iyer Shridhar Ganpathi
Dr Alfred Kow Wei Chieh

Gastroenterology & Hepatology
Prof Ho Khek Yu Lawrence
Prof Lim Seng Gee
A/Prof Dan Yock Young
Dr Bhavesh Kishor Doshi
Dr Michelle Angela Gowans
Dr Leo Hartono Juanda
Dr Lee Guan Huei
Dr Lee Keat Hong
Dr Lee Yin Mei
Dr Kieron Lim Boon Leng
Dr Low How Cheng
Dr Tan Poh Seng
Dr Thwin Maung Aye

Diagnostic Imaging
E/Prof Lenny Tan
Dr Khor Lih Kin
Dr Stanley Loh Eu Kuang
Dr Neo Wee Thong
Dr Prapul Rajendran
Dr Mangat Kamarjit Singh
Dr Pavel Singh
Dr Thian Yee Liang
Dr Bernard Wee
Dr Yang Cunli

Pathology
Prof Aileen Wee
Dr Pang Yin Huei
Dr Benjamin Wong Pak Kwong

Haematology-Oncology
Dr Chee Cheng Ean
Dr Thomas Soh I Peng
Dr Yong Wei Peng

Radiation Oncology
Dr Francis Ho
Dr Leong Cheng Nang
Dr Jeremy Tey Chee Seong

Lung/Thoracic Cancer

Haematology-Oncology
Dr Ross Soo (Leader)
Adj A/Prof Goh Boon Cher
Dr Chin Tan Min
Dr Tan Chee Seng
Dr Alvin Wong Seng Cheong

Surgical Oncology
A/Prof John Tam Kit Chung
A/Prof Thirugnanam Agasthian

Respiratory & Critical Care Medicine
Prof Lim Tow Keang
A/Prof Lee Pyng
Dr Adrian Kee
Dr Khoo Kay Leong
Dr See Kay Choong

Diagnostic Imaging
Dr Arvind Kumar Sinha
Dr Anil Gopinathan
Dr Loi Hoi Yin
Dr Lynette Teo Li San

Pathology
Dr Seet Ju Ee

Radiation Oncology
Dr Koh Wee Yao
Dr Leong Cheng Nang
Dr Tham Weng Keong Ivan

Prostate/Urology Cancer

Surgical Oncology
Prof Kesavan Esuvaranathan (Leader)
A/Prof Edmund Chiong
Dr David Terrence Consigliere
Dr Tan Guan Lim Lincoln
Dr Tiong Ho Yee

Diagnostic Imaging
Dr Bertrand Ang Wei Leng
Dr Wynne Chua Yuru
Dr Edwin Siew Poh Yiew

Pathology
Prof Teh Ming
Dr Thomas Paulaj Thamboo

Haematology-Oncology
Prof John Wong Eu-Li
Dr Alvin Wong Seng Cheong

Radiation Oncology
Dr David Chia
Dr Keith Lim Hsiu Chin
Dr Jeremy Tey Chee Seong

Upper Gastrointestinal Cancer

Surgical Oncology
A/Prof Jimmy So Bok Yan (Leader)
E/Prof Ti Thiow Kong
Dr Asim Shabbir

Gastroenterology & Hepatology
Prof Ho Khek Yu Lawrence
A/Prof Yeoh Khay Guan
Dr Lim Li Lin
Dr David Ong Eng Hui

Pathology
Prof Teh Ming
Dr Brendan Pang Nghee Kheem
Dr Benjamin Wong Pak Kwong

Haematology-Oncology
Dr Chee Cheng Ean
Dr Thomas Soh I Peng
Dr Yong Wei Peng

Radiation Oncology
Dr Francis Ho
Dr Leong Cheng Nang
Dr Jeremy Tey Chee Seong

Diagnostic Imaging
Dr Prapul Rajendran
Dr Pavel Singh
Dr Bernard Wee
Dr Yang Cunli
Dr Yeong Kuan Yuen

Paediatric Haematological Malignancies

Paediatric Haematology - Oncology
A/Prof Quah Thuan Chong (Leader)
Prof Dario Campana
A/Prof Allen Yeoh Eng Juh
Dr Elaine Coustan-Smith
Dr Chetan Anil Dhamne
Dr Krista Francisco
Dr Koh Pei Lin
Dr Kimpo Miriam
Dr Tan Poh Lin
Dr Mariflor Villegas
Dr Frances Yeap

Radiation Oncology
Dr Vicky Koh
Dr Johann Tang I-Hsiung

Musculoskeletal Cancer/Sarcoma

Hand & Reconstructive Microsurgery
Dr Mark Puhaindran (Leader)
E/Prof Robert Pho Wan Heng

Orthopaedic Surgery
Dr Gurpal Singh

Diagnostic Imaging
A/Prof Quek Swee Tian
Dr Sachin Agrawal
Dr Arvind Kumar Sinha
Dr Louise Gartner
Dr James Hallinan
Dr Lee Chin Hwee
Dr David Sia
Dr Salil Singbal

Pathology
Dr Victor Lee Kwan Min

Haematology-Oncology
Dr Angela Pang
Dr Alvin Wong Seng Cheong

Radiation Oncology
Dr Timothy Cheo
Dr Choo Bok Ai
Dr Ooi Kiat Huat
Dr Wong Lea Choung

Paediatric Haematology-Oncology
Dr Chetan Anil Dhamne

Supportive and Palliative Care

Haematology-Oncology
Dr Noreen Chan Guek Cheng (Leader)
Dr Yong Woon Chai
Dr Jamie Zhou

Radiation Oncology
Dr Wong Lea Choung

Psychological Medicine
A/Prof Rathi Mahendran
Dr Terence Leong Sun Chee

Developmental Therapeutics Unit (DTU)

Haematology-Oncology
Adj A/Prof Goh Boon Cher (Leader)
Prof Chng Wee Joo
Adj A/Prof Lee Soo Chin
Dr Chee Cheng Ean
Dr Ross Soo
Dr David Tan
Dr Andrea Wong
Dr Yong Wei Peng

NCIS Events (Jan - Jul'16)

JAN

1. January Oncology Grand Rounds
Date: 13 Jan
Time: 1.00pm – 2.00pm
Venue: NUHS Tower Block, Level 7, Seminar Rooms T07-03/04, Singapore 119228
Topic: Advances in Radiation Therapy
Speaker: Dr Ivan Tham, Senior Consultant, Department of Radiation Oncology, NCIS

FEB

World Cancer Day

1. Corporate Talk
Date: 16 Feb
Time: 3.00pm – 4.30pm
Venue: MINDEF Nee Soon Camp, 303 Transit Road, Singapore 778895

2. February Oncology Grand Rounds
Date: 17 Feb
Time: 1.00pm – 2.00pm
Venue: NUHS Tower Block, Level 7, Seminar Rooms T07-03/04, Singapore 119228
Topic: Concepts in Oncology: Tumour Xenografts
Speaker: Professor Hunyh Hung, Principal Investigator, Laboratory of Molecular Endocrinology, Division of Cellular & Molecular Research, National Cancer Centre Singapore

3. World Cancer Day
Date: 20 Feb
Time: 9.00am – 5.30pm
Venue: Toa Payoh HDB Hub Arena, 460 Lorong 6 Toa Payoh, Singapore 310460

HDB Hub Bedok Room	*9.00am – 10.15am*	*English Talk: Women's Gynaecological Cancers*
	10.45am – 12.00pm	*Mandarin Talk: 女性癌症*
HDB Hub Punggol Room Basement 1	*2.00pm – 3.30pm*	*English Talks:* • *What is Cancer? Nutritional and Cancer Prevention* • *TCM and Cancer*
	4.00pm – 5.30pm	*Mandarin Talks:* • 癌症是什么? 养生之道与预防癌症 • 中医治疗与癌症

MAR

Colorectal Cancer Awareness Month

1. Bukit Batok Polyclinic Talk
Date: 9 Mar
Time: 1.00pm – 2.00pm
Venue: 50 Bukit Batok West Ave 3, Singapore 659164

2. March Oncology Grand Rounds
Date: 16 Mar
Time: 1.00pm – 2.00pm
Venue: NUHS Tower Block, Level 11, Seminar Rooms T11-02/03
Topic: Cytoreductive Surgery & HIPEC – Treatment Advances for Peritoneal Malignancy
Speaker: Dr Bettina Lieske, Consultant, Division of Colorectal Surgery, National University Hospital

3. GP CME
Date: 19 Mar
Time: 2.00pm – 4.00pm
Venue: NUHS Tower Block Auditorium, 1E Kent Ridge Road, Singapore 119228

4. Clementi Polyclinic Talk
Date: 23 Mar
Time: 1.00pm – 2.00pm
Venue: 451 Clementi Avenue 3, #02-307, Singapore 120451

APR

1. GP CME
Date: 2 Apr
Time: 2.00pm – 4.00pm
Venue: NUHS Tower Block Auditorium, 1E Kent Ridge Road

2. Choa Chu Kang Polyclinic Talk
Date: 13 Apr
Time: 1.00pm – 2.00pm
Venue: 2 Teck Whye Crescent, Singapore 688846

3. April Oncology Grand Rounds
Date: 13 Apr
Time: 1.00pm – 2.00pm
Venue: NUHS Tower Block, Level 7, Seminar Rooms T07-03/04
Topic: Subgroup Analysis in Clinical Trials
Speaker: Dr Chan Yiong Huak, Head, Biostatistics Unit, Yong Loo Lin School of Medicine, National University of Singapore

MAY

1. Singapore Sarcoma Symposium
Date: 7 May
Time: 10.00am – 12.00pm
Venue: NUHS Tower Block Auditorium, 1E Kent Ridge Road

2. Corporate Talk
Date: 25 May
Time: 12.00pm – 1.00pm
Venue: Firmenich Asia Pte Ltd, 10 Tuas West Road, Singapore 638377

3. May Oncology Grand Rounds
Visit www.ncis.com.sg for more info

JUN

Ovarian Cancer Awareness Month

1. Stereotactic Body Radiation Therapy (SBRT) International Symposium
Date: 20 June – 24 June
Venue: NUHS Tower Block, 1E Kent Ridge Road, Singapore 119228

2. June Oncology Grand Rounds
Visit www.ncis.com.sg for more info

JUL

1. 3rd NCIS Annual Research Meeting (NCAM 2016)
Date: 1 Jul
Time: 8.30am – 6.00pm
Venue: NUHS Tower Block Auditorium, 1E Kent Ridge Road, Singapore 119228

National University Cancer Institute, Singapore
A member of the NUHS

(65) 6773 7888 (65) 6777 4413 CancerApptLine@nuhs.edu.sg www.ncis.com.sg
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