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Title: Updated loss function for accurate tumor segmentation from breast MRIs

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We present Focal Boundary Dice, a new segmentation evaluation measure focused on boundary quality and class imbalance. We perform an extensive analysis across different error types and object sizes of imaged tumors from MRI scan and show that Focal Boundary Dice is significantly more sensitive than the standard Focal and Dice measures to boundary errors for imaged tumors from MRI scans and does not over-penalize errors on division of the boundary, including smaller imaged objects. The new quality measure displays several desirable characteristics, like higher accuracy in the selection of hard samples, prediction/ground truth pairs, and balanced responsiveness across scales, which makes it more suitable for segmentation evaluation than other classification focused measures such as combined IoU and BCE loss, Boundary BCE loss and Shape-aware Loss.

Methods: Based on Boundary Dice, we update the standard evaluation protocols for tumor segmentation tasks by proposing the Focal Boundary Dice. We mainly solve the contradiction between target and background area and the contradiction between the importance and attention of boundary features. Meanwhile, a boundary attention module is introduced to further extract tumor edge features.

Results: Our experiments show that the new evaluation metrics allow boundary quality improvements and image segmentation accuracy that are generally overlooked by current Mask Dice based evaluation metrics and deep learning models. The adoption of the new boundary-sensitive evaluation metrics leads to rapid progress in segmentation methods that enables the improvement of boundary quality. The optimal configuration of focal boundary dice loss is performed for the resultant segments of imaged tumors as shown in [Figure 1]. This focal boundary dice loss enables the construction of the deep learning network for good segmentation performance in all tested MRIs. The quantification results are listed in [Table 1].
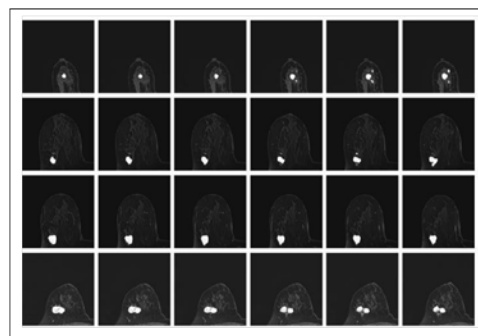

Figure 1. The resultant segments of imaged tumors under the Focal boundary dice loss. The segmented tumors are overlayed on the original data.

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Model	Dice	Precision	Specificity
U-Net	0.73	0.81	0.99
ResUNet	0.76	0.82	0.99
Pix2pix	0.58	0.78	0.99
Att-UNet	0.76	0.80	0.99
2D-VNet	0.74	0.84	0.99
DenseUNet	0.76	0.80	0.99
Our	0.82	0.94	0.98

Conclusion: The proposed deep learning model enables to achieve efficient discrimination between healthy and diseased tissues, and paves the way for the automatic diagnosis of breast cancer.

Biography

Xiao-Xia Yin received the PhD degree in electronics engineering from The University of Adelaide, Australia. She was a Visiting Scholar with the University of Reading, Reading, U.K., under the supervision of S. Hadjiloucas and with the University of Cambridge, Cambridge, U.K., under the supervision of L. F. Gladden. She involved in tumor detection via DCE-MRI with The University of Webinar, under the supervision of Prof. Kotagiri. She has an existing collaboration with Prof. M.Y. Su with the Center for Functional Onco Imaging, University of California at Irvine, USA, and with Prof. T. Kron with the Peter MacCallum Cancer Centre, Australia. She is currently a professor in University of Guangzhou, China and her major is in high-dimensional medical image analysis. Her research interests include multi resolution analysis, segmentation, image reconstruction and classification and their applications to high-dimensional medical imaging. She received the Postdoctoral Research Fellowship from the Australian Research Council in 2009. She was a member of the Organizing Committee and the Publication Chairperson of the 3rd International Conference of Health Information Science and a member of the Organizing Committee and the Program Co-Chairperson of the 4th and 5th International Conference of Health Information Science.

Title: Breast cancer cytology and ancillary techniques in Low Middle Income Group Countries (LMIC) like India

Nandini NM

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Statement of the problem: Breast cancer is the most diagnosed cancer globally. In 2020, there were an estimated 684,996 deaths from breast cancer, with a disproportionate number of these deaths occurring in low-resource settings. Fine Needle Aspiration Cytology (FNAC) has been established as an important tool in the evaluation of breast lesions in low resource settings. Manual Liquid Based Cytology (MLBC) is designed to improve Conventional Smears (CS) by avoiding limiting factors such as obscuring material, air-drying and smearing artifacts. The residual samples for ancillary techniques are Immuno Cyto-Chemistry (ICC), flow cytometry and molecular biology. Cell blocks are micro-biopsy which employs retrieval of small tissue fragments from FNA specimen and is then fixed and processed with standard histopathology technique. It offers high diagnostic accuracy, cost-effectiveness and rapidity of results. There are several biomarkers which play a role in diagnosis, treatment and prognosis of breast lesions. ER PR are nuclear markers, HER2 and KI67 which proliferation markers with ECADHERIN and CD 34 are important for diagnosing metastasis, which can be tested on FNAC, MLBC and cell block of breast [Figure 1].

Figure 1. Showing different diagnostic methods of breast lesions in low middle income group countries (LMIC).

Methodology & theoretical orientation: The various cost effective methods are studied and their advantages and limitations are studied. It was found that based on the condition of the breast any one or all the method was studied and the diagnosis was confirmed by histopathology wherever possible.

Conclusion: It was found that FNAC of breast is still a good cost effective method for diagnosis of breast lesions; MLBC was found to be useful in breast lesions where the cytological and nuclear features were clearly made out. ICC was possible on both FNAC and MLBC. Cell block has helped in confirming the diagnosis in grey zone breast lesions as it almost represents histopathology, it can be used for panel of biomarkers.

Biography

Nandini NM, Professor, JSS Medical College, Mysore, is attached as a teaching faculty from the past 25 years in the department of pathology. She has finished her MBBS from JNMC BELGAVI, MD from Mysore Medical College and Research Institute. She has worked in the field of cytology of cervix and breast. She has attended and given talks at many national and international conferences in countries like U.K, USA, Singapore and Netherland. She has worked on liquid based cytology, cell block technique and has come up with indigenous methods. She has several publications and books to her credit written on cervical and breast cancer.

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Title: Immune oncology therapy for breast cancer: CCR5 inhibitors enhance breast cancer cell killing and reduce doxorubicin-induced cardio-toxicity

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We previously showed that the G-protein coupled receptor CCR5 is expressed on both immune and epithelial cells of ~50% of human Breast Cancers (BCa), thereby inducing cancer "stemness", cell survival and DNA repair and a pro-metastatic phenotype. CCR5 inhibition by small molecules (Maraviroc) or a humanized monoclonal antibody (Leronlimab) reduced the breast cancer metastatic burden in murine models, with distinct impact on secretomes and promising results in a Phase 1B/2 study. With cancer survivors estimated at 19 million in the USA by 2025, DOX-induced cardio-toxicity is considered part of the "cardio-oncology epidemic".

Herein, we show that:

i. CCR5 inhibitors (CCR5i) enhanced DOX-induced cell death of breast cancer cells.

ii. CCR5 and its ligand CCl5 were induced by DOX in cardiac myocytes in both the hearts of patients undergoing cardiac transplantation for DOX-induced cardiomyopathy and in a murine model of DOX-cardiac toxicity.

iii. CCR5i protected human iPSC-derived cardiomyocytes and isolated canine cardiomyocytes from DOX- induced cell death.

iv. CCR5i substantially reduced (>90%) DOX-induced cardiac dysfunction in mice.

We conclude that CCR5 inhibitors (CCR5i) are "dual function" compounds that provide both cardiac protection and enhanced breast cancer cell killing in the presence of DNA damaging chemotherapy agents. Our studies may have a broad impact by identifying a novel approach to both enhancing therapeutic efficacy and providing cardio-protection from DNA damaging agents that are widely used in cancer treatment.

Keywords: Breast cancer, Metastasis, CCR5, Cardio-toxicity, Prevention.

Biography

Richard Pestell, AO, MD, PhD, MB, BS, MBA, FRACP, FACP is President Pennsylvania Cancer and Regenerative Medicine Center, Philadelphia, USA. He is a clinician scientist who was appointed Officer of the Order of Australia in the 2019 Queen's Birthday Honors for distinguished service to medicine, in the fields of endocrinology and oncology. He has >700 published works (>89,000 citations, H index 153) and holds patents in cancer diagnostics and treatment. He was previously Executive Vice President Thomas Jefferson University, Philadelphia, USA. He received MD and PhD degrees from Melbourne University, his MBA from NYU and was the Winthrop Fellow at Harvard Medical School and was Clinical Fellow at Massachusetts General Hospital. He identified key genetic target for cancer stem cells governing the onset and progression of cancer, with issued patents that have led to a current clinical trial.

Title: BRCA1/2 mutation in a cohort of young women breast cancer in Mauritania

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Introduction: Breast Cancer (BC) is the leading cause of death in African women. The aim of this cross–sectional study was to assess the incidence, clinico-pathological characteristics, risk factors and outcome of breast cancer in Mauritania. BC of women under the age of 40 is a complex disease because more than 90% of young patients with BC are symptomatic. Data on BC in young women breast cancer is limited and the cancer characteristics mutation BRCA1/A2 genes are less well studied.

This study was aimed to provide the first data on young women in BC the incidence, clinico-pathological characteristics, risk factors and related gene mutations in Mauritania.

Materials and methods: Thirty-three percent young women were referred to the Centre National d'Oncologie (CNO) in Mauritania between January 2009 and December 2020. We evaluated clinical characteristic, treatment selection and screening mutation BRCA1/A2 genes.

Results: The Thirty-three percent young women with BC recruited in this study were aged between 21 and 39 years. Infiltrating ductal carcinoma was the predominant histological type in 90% of cases. Multimodal treatment was based on mastectomy followed by adjuvant therapy including chemotherapy, radiation therapy and/or hormonal therapy, depending on tumor stage and its histological features. Metastases mainly occurred in the bones (59%).

We identified five predominant BRCA1/2 variants: (c.815_824insAGCTATGTGG,c.2612C>T,c.813_814insTAGCCATGTG, c.201-18del) and (c.4986+6T>C). We also found one BRCA2 missense variants (c.10247A>G). Interestingly, we identified two novels BRCA DNA variants in of which 1 were predicted as pathogenic.

Conclusion: Further research is needed to address gaps in knowledge pertaining to care of young women breast cancer patients and survivors.

Keywords: Breast Cancer (BC), TNBC, young women, BRCA1/2, Mauritania.

Biography

Selma Mohamed Brahim is a Mauritanian PhD in genetics and molecular biology. She have a research on BRCA1 and BRCA2 genes of the cancer in Mauritania and she had done numerous training programs in Mauritania and abroad, she had developed a strong skill set in biomedical, molecular bioinformatics sciences. She has master in biology and health Sciences at HASSEN II University/Morocco. She also has been the coordinator of the research and education unit at the National Center of Oncology since 2020 in Mauritania.

Title: Neuropilin-1 knockout and rescue confirms its role to promote metastasis in MDA-MB-231 breast cancer cells

Sirin A Adham

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Breast Cancer (BC) metastasis remains a leading cause of female mortality. Neuropilin-1 (NRP-1) is a glycoprotein receptor that plays ligand-dependent roles in BC. Clinical studies indicate its correlation with metastatic disease; however, its functional role in BC metastasis remains uncertain. CRISPR-Cas9 was used to knockout the NRP-1 gene in MDA-MB-231 BC cells and the effects on metastasis were determined using an orthotopic mouse engraftment model. NRP-1 expression in knockout cells was rescued using a recombinant cDNA with a silent mutation in the sgRNA target-adjacent PAM sequence. Differentially expressed genes between NRP-1 knockout and control cells were determined using whole-transcriptome sequencing and validated using real-time PCR. NRP-1KO cells showed a pronounced reduction in the metastasis to the lungs. KEGG pathway analysis of the transcriptome data revealed that PI3K and ECM receptor interactions were among the top altered pathways in the NRP-1KO cells. In addition, reduction in metastasis enhancer's proteins, Integrin-ß3 and Tenascin-C and genes CCL20 and FN1 and up-regulation of metastasis suppressor genes, ACVRL and GPX3 in NRP-1KO were detected. These findings provide evidence for a functional role for NRP-1 in BC metastasis, supporting further exploration of NRP-1 and the identified genes as targets in treating metastatic BC.

Biography

Sirin A Adham Graduated from the University of Leon, Spain, in 2002 with a PhD degree in Biological Sciences/molecular biotechnology. She worked at the Department of Biology, University of Waterloo, Canada as a postdoctoral fellow on a project funded by Genome Canada from 2003-2006. From 2006-2009 she joined the Department of Biomedical Sciences at the University of Guelph, Canada as a Postdoctoral fellow and held the Associate Scientist's title in Cancer Research. In 2010, she joined the Department of Biology, College of Science, SQU, Oman. She was promoted to Associate Professor in May of 2019. Her research is focused on Cancer Molecular Biology to investigate the molecular basis of drug resistance in breast cancer. She has published her research in several highly ranked peer-reviewed international journals and was awarded research funds from SQU, Oman's Research Council (TRC) and the international Terri Fox foundation fund. Finally, she built her cancer research laboratory and supervised PhD and MSc. students at the Department of Biology (SQU).

Title: Tackling triple negative breast cancer through nanotechnological interventions: Promise and pitfalls

Partha Roy

GITAM School of Pharmacy, India

Global socioeconomic revolution with overlying stress motivators remains as the main stimulus behind rising cancer cases across global frontiers. Among diverse cancer variants, female breast cancer has emerged as the most detected type although it is predominantly gender selective. This stands out as the prominent cause of the rapid spread of the disease. Triple Negative Breast Cancer (TNBC) is an extremely intrusive variant of BC and is visible in approximately 20% of all BC cases. Moreover, the disease offers poor prognosis with increased risk of relapse after conventional chemotherapy. TNBC also leads to metastasis of the lung, liver and brain and presents the highest death rate among all other breast cancer types. Spotlight on the etiology of TNBC related mortality confirms tumour migration and ancillary tumour growth in migrated sites as the pivotal causes. Adding to the complexity, strategies for TNBC management often involves non-targeted chemotherapeutic schedules leading to undesired fatalities, as the disease lacks suitable targets like Estrogen Receptor, Progesterone Receptor and HER-2 Receptor. Contemporary treatment strategy for TNBC involves a blend of chemotherapy, surgery and radiation depending on the patient condition. Designing formulation stratagems for site-directed nanotherapeutics can provide a suitable solution to the complex clinical condition. However, biocompatibility and absence of residual toxicity remains a major challenge in the clinical translation of these technology-guided newer therapeutic arsenals.

Biography

Partha Roy is a Professor in GITAM School of Pharmacy, GITAM (Deemed to be University), India. He completed his PhD from University of Calcutta with post-doctoral assignments from University of Calcutta and University of Szeged, Hungary. He received several distinguished fellowships including Indian Council of Medical Research, Council of Scientific and Industrial Research and Indo-Hungarian Research fellowship. His academic and research engagements include both India and overseas. His research focuses on nanotechnological interventions in medicine, drug delivery, formulation development and cell-imaging. Currently he is experimenting with carbon/gold nanomaterials as newer arsenals in therapy and diagnostics. His research assignments include several high-impact publications in peer reviewed journals journal editorial board membership, invited lectures and presentations in national/international conferences. He is the recipient of several research funds, research awards and travel grants in both India and overseas. He is a passionate researcher and academician motivated to excel in pharmaceutical and other healthcare domains.

Title: Kitchen Waste derived Carbon nanodot in the treatment on Triple Negative Breast Cancer: A waste to wealth approach

Suvadra Das

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Breast cancer is the most commonly diagnosed malignancy in women, and the second leading cause of cancer-related mortality worldwide. The objective of the WHO Global Breast Cancer Initiative (GBCI) is to reduce global breast cancer mortality by 2.5% per year, thereby averting 2.5 million breast cancer deaths globally between 2020 and 2040. Early detection, timely diagnosis and comprehensive breast cancer management are the three bastion to achieve the ambitious target of WHO. The scenario is more complex in Triple-negative breast cancer (TNBC) which accounts for 10–20% of breast cases. Triple-negative breast cancer (TNBC) cells are deficient in estrogen, progesterone and ERBB2 receptor expression, presenting a particularly challenging therapeutic target due to their highly invasive nature and relatively low response to therapeutics. There is an absence of specific treatment strategies for this tumor subgroup, and hence TNBC is chemotherapy sensitive and common chemotherapy includes anthracyclines and taxanes. The problems associated with conventional drugs are unfavorable pharmacokinetics, lack of selectivity and serious cumulative toxicity. Due to their cheap and easy synthetic strategy, carbon nanodot with large number of surface functional groups provides high surface area suitable for high drug loading. Further conjugation of targeting moiety on the surface helps the therapeutics to achieve better delivery efficiency thereby reducing side effects and improving drug tolerance. Carbon nanodots also inherit special optical properties due to quantum confinement effect, hybridization of carbon backbone, molecule state and crosslink enhanced emission. Unique photoluminescence property of carbon nanodot makes them ideal theranostic agent suitable for simultaneous therapeutic and diagonostic application. Our research focused on developing kitchen waste derived carbon dot as drug carrier for anthracyclin epirubicin with specific targeting moiety for the treatment of TNBC. Moreover the unique excitation dependent emission fluorescence added detection potential to this low toxic arsenal making them unique theranostic agent against TNBC.

Biography

Dr. Suvadra Das [Ph.D.(Tech.) in Pharmaceutical and Fine Chemical Technology] is currently working as Professor (chemistry) at University of Engineering and Management Kolkata. Her research focuses on nanotherapeutics development with different insoluble plant bioactives as alternative medicines in disease specific conditions. Dr Das has successfully developed flavonoid tagged gold nanotherapeutics for resistant leshmaniasis and different polymeric nanotherapeutics with plant bioactive payload for diabetes, hepatic dysfunctions and cancer onditions. She has also worked on in silico molecular modeling studies and application of quantitative structure performance relationship (QSPR) tools to derive theoretical models for optimal molecular loading in polymer based nanotherapeutics. Presently Dr Das is working on development of target specific theranostic carbon naodot for the treatment of breast cancer following waste to wealth approach.

Title: Community approaches for early screening and referrals for breast cancer treatments: Case of test and treat intervention in Nyamira County- Kenya

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Introduction: Breast cancer is among the most common cancers in Kenya with approximately 6,000 new cases and 2,500 deaths per year, Most of which present at advanced stages. Early detection combined with effective treatment can achieve survival probabilities of 90% or higher. The Kenyan Ministry of Health (MOH) is committed to reducing cancer mortality, as evidenced by policies such as the National Cancer Control Strategy (2017–2022). Although there are many Kenyan organizations devoted to this task, effective coordination is lacking resulting in inefficient and overlapping expenditure of resources. At community level, misconceptions and stigma surrounding cancer etiology, prevention, screening and treatment have emerged increasing late detection and delays in early treatment.

Methods: KMET in collaboration with Nyamira County Government, Department of Health and Stanbic Bank Foundation conducted a cancer prevention project dabbed Test & Treat with the aim of reducing the overall incidences, early diagnosis and treatment of breast cancer with HPV vaccination drive Kisii County. The approach was through outreach base, incorporating cancer awareness creation sessions by use of Community Health Volunteers (CHVs) to increase self-examination, screening and treatment at the community level.

Findings: Throughout the period of February 2023, a total of 2557 women were reached with cancer awareness messages especially breast cancer, 1251 women examined and 11 referred for further examinations and treatment in government facilities. A total of 7941 adolescents were provided HPV 1 and 2 vaccinations.

Recommendations: Engage community leaders to identify and break key drivers of stigma during community awareness; develop culturally appropriate messages to address knowledge gaps on breast cancer; work with MOH for a coordinated referral systems from the community to facility level and advocate for a National Health Insurance Fund that supports the most vulnerable women access breast cancer treatment.

Conclusion: Taking services to communities especially through outreaches ensures access to the most at need and reduces late diagnosis and treatment of breast cancer.

Biography

Caroline Nyandat is Sexual and Reproductive health expert and advocate with over 13 years' experience in women's rights and health. As a nurse health care manager, sociologist, trainer, mentor and service provider she has ensured effective implementation of Integrated Sexual Reproductive Health and Rights in 23 counties in Kenya focusing on women as the central point of care. Currently as a program Associate at KMET she coordinates implementation of Reproductive, Maternal Neonatal and Adolescent Health interventions in 23 counties in Kenya through county and community partnerships. Her passion has been having adolescent girls and women of reproductive age being integral and central to access friendly services using various innovations.