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Renal Denervation: Antihypertensive or Gizmo Idolatry?

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Gizmo idolatry can be defined as the willingness to accept, in fact to prefer, unproven, technologically oriented medical measures. [2] J. Robert Oppenheimer, at the hearing before the Personnel Security Board of the U.S. Atomic Energy Commission (USAEC) in 1954, humbly acknowledged: “When you see something that is technically sweet, you go ahead, and do it, and you argue about what to do about it only after you have had your technical success.”[3] A high-tech approach often bestows a halo of expertise and pre-eminence on the gizmologist, and despite uncertainty or lack of benefits, incentives can be considerable. And, as stated above, in the context of leeches for medical use, the theatrics are undeniable.[1]

Antihypertensive Drug Therapy

The more bromidic a medical issue, the easier it will be hijacked by a high-tech approach whenever the opportunity presents itself. As such, run-of-the-mill antihypertensive therapy can be considered as an ideal target: Ever since the National Heart, Lung, and Blood Institute advocated the stepped-care approach, antihypertensive therapy has lost its highbrow luster to clinicians; over years, if not decades, little if any change in prescription patterns has occurred. With >80 million prescriptions per year, lisinopril remains the most common used antihypertensive in the United States, followed by amlodipine and hydrochlorothiazide. Prescribing these drugs is not exactly a cognitive challenge for most physicians, although despite wide-available medications and lifestyle interventions, blood pressure (BP) control rates remain precariously low.[4]

The arrival of renal denervation (RDN) in 2011 is what allowed the redefinition of antihypertensive therapy as a high-tech item rather than something mundane like prescribing a pill or 2. After the initial excitement sparked by uncontrolled studies waned, a subsequent decade of intense research has provided reliable data allowing the assessment of RDN’s efficacy and safety. In November of last year, the U.S. Food and Drug Administration (FDA) approved 2 renal denervation systems for the treatment of hypertension.

- **Efficacy**

- The FDA's approval of antihypertensive drugs is solely based on a surrogate endpoint, that is, BP criteria. Clinicians often are impressed by the profound BP response immediately after RDN. However, in the data submitted to the FDA,[5] the decrease in systolic BP after 2 months amounted to <5 mm Hg compared with sham, after 6 months, it was 3 mm Hg. Long-term durability remains uncertain because in the pivotal trials, patients and physicians were at liberty to change medications. Also, up to one-third of patients do not respond, with BP remaining unchanged or even rising.[6] Intense efforts to identify responders and nonresponders have not proved to be successful. This means that many patients will undergo a painful invasive procedure without having benefits. There also is concern that the lesioned renal nerves may regenerate, thereby possibly reversing the BP lowering effect.[7]

- By contrast, a well-established antihypertensive such as amlodipine does lower systolic BP by >10 mm Hg in a day, and does so in a week, in a month, in a year, and in 10 years. Importantly, the drug not only lowers the surrogate of BP but also decisively reduces outcome, that is, the risk of stroke, heart attack, and death. No such information is available with RDN, and with its FDA approval, it is unlikely that there ever will be. RDN allegedly lowers BP by interfering with sympathetic activity, a mechanism akin to beta blockade. Compared with other antihypertensive drug classes, beta-blockers, despite lowering BP, have consistently demonstrated little if any efficacy in reducing outcomes in hypertensive cardiovascular disease.[8]

- **Safety**

- Based on the limited number of procedures done so far, RDN appears to be safe. Despite its lesioning the renal arteries, no subsequent stenoses were reported. [6] This holds true when the bar was set at the deceptively high level of >70% occlusion. However, closer scrutiny of the computed tomography angiography/ magnetic resonance angiography data set in the FDA executive summary reveals 3 patients with a 31% to 50% occlusion and 2 patients with a 51% to 70% occlusion, corresponding to 2.7% and 1.8% of the patient population, respectively.[5] These figures are of concern for a procedure poised to be used in a prevalent condition such as treatment-resistant hypertension. There is wide variability in the reported prevalence of treatment-resistant hypertension with rates from 3% to 30% of hypertensive patients.[9,10]

- With the FDA approval, RDN companies intend to immediately begin widespread commercialization. News media in the United States have recently touted RDN as "game-changing" for people with uncontrolled hypertension. How much of a game-changer is an invasive procedure that lowers systolic BP on average by a 3 to 4 mm Hg after 6 months and is ineffective in many patients?

- While pondering this and similar questions, clinicians may want to take a fresh look at antihypertensive therapy, however mundane it may be perceived. What your attending was teaching you a few years ago may no longer be state-of-the-art. In many a patient with so-called resistant hypertension, BP levels can be lowered by improving adherence and simply using a more synergistic treatment strategy.

- **Guidelines**
- Most national and international hypertension guidelines were published before FDA approval of RDN. They either sidestep the topic of RDN or approach it carefully and leave recommendations open-ended. A recent exception is the just published 2024 hypertension guidelines of the European Society of Cardiology (ESC).[11] They suggest that device-based therapy should be considered in selected patients with resistant hypertension who express a preference to undergo RDN after a shared risk-benefit discussion and multidisciplinary assessment of the BP-lowering effect. However, despite this, the guideline's verdict remains: "Use of device-based therapies is not recommended for the routine treatment of hypertension... until further evidence regarding their safety and efficacy becomes available."[11] Thus, ESC guidelines consider RDN Class IIb for treatment of resistant hypertension or for patients with uncontrolled hypertension and high cardiovascular disease risk.
- **Refractory Hypertension**
- The predominant mechanism underlying resistant hypertension is fluid-volume retention, mediated most often by mineralocorticoid excess.[12] By contrast, the rare patients with refractory hypertension, defined as a phenotype of antihypertensive treatment failure in which BP remains uncontrolled despite maximal therapy, often exhibit increased sympathetic nervous system activity.[12] Most clinicians regard refractory hypertension as an end-of-the-rope situation; I certainly consider it to be an appropriate clinical indication for resorting to RDN.
- **Conclusion**
- Gizmo idolatry is a pervasive phenomenon, not restricted to medicine. It consists in glorifying gadgets as more than just tools and elevating them to a level of importance or reverence that goes far beyond their documented risk-benefit ratio. Before becoming too ensnared by RDN as innovative antihypertensive therapy, we should remember the statement of the chairman of the FDA advisory committee, Dr Richard Lange, who on August 23, 2023, had to break the member's split vote on RDN approval: "At the end of the day, I can't honestly look patients in the eye and tell them that the benefit outweighs the risk for the population at large."[13]

Medscape Medical News

New Level of Evidence Links Shingles Vaccine to Lower Dementia Risk

Megan Brooks

April 02, 2025

New research suggests that the shingles vaccine Zostavax may protect against dementia, supporting the theory that viruses that affect the nervous system may contribute to neurodegeneration.

The study, which leveraged a unique vaccine rollout policy in Wales and analyzed the health records of more than 280,000 older adults, showed that receipt of the live-attenuated shingles vaccine reduced the probability of developing dementia by around one fifth over 7 years.

"Shingles vaccination is recommended for older adults. If the shingles [vaccine] has a benefit for dementia delay or prevention in addition to its preventive benefit for shingles, then this is all the more reason to get vaccinated," study investigator Pascal Geldsetzer MD, PhD, MPH, Departments of Medicine and Epidemiology and Population Health, Stanford University in California, told *Medscape Medical News*.

"Our study takes a fundamentally different approach and, thus, provides a very different level of evidence," Geldsetzer said.

The researchers took advantage of the fact that, in Wales, eligibility for the live-attenuated varicella zoster vaccine was determined on the basis of an individual's exact date of birth. Those born before September 2, 1933, were ineligible and remained ineligible for life, whereas those born on or after September 2, 1933, were eligible for at least 1 year to receive the vaccine.

"This is just like a randomized trial. We have a vaccine-eligible and a vaccine-ineligible group for which we know that they should be, on average, similar to each other, and therefore good comparison groups, because all that's different about these two groups is if they were born a few days earlier or a few days later," Geldsetzer explained.

The electronic health record data showed that the percentage of adults who received the zoster vaccine increased from 0.01% among patients who were merely 1 week too old to be eligible, to 47.2% among those who were just 1 week younger.

“We see in our data that just a 1-week difference across this date-of-birth cutoff means that you go from essentially no one getting vaccinated to about half of the population getting vaccinated,” said Geldsetzer.

Using these comparison groups, the researchers found that receiving the zoster vaccine, vs not receiving the vaccine, reduced the probability of a new dementia diagnosis over 7 years by 3.5 percentage points, corresponding to a 20% relative reduction.

This protective effect was more pronounced in women, potentially due to stronger vaccine-induced immune responses or higher shingles prevalence.

The researchers replicated their findings in health records from other countries, including England, Australia, New Zealand, and Canada, which had similar rollouts of the zoster vaccine.

“We just keep seeing this strong protective signal for dementia in dataset after dataset,” Geldsetzer said in a Stanford University news release.

Geldsetzer has set his sights on a large, randomized controlled trial of the potential neuroprotective effects of the live-attenuated zoster vaccine, “which is the vaccine for which we have generated our compelling body of evidence.”

“It would be a very simple, pragmatic trial because we have a one-off intervention that we know is safe,” Geldsetzer said. He is seeking philanthropic funding for the trial as the live-attenuated vaccine is no longer manufactured by pharmaceutical companies.

It is unknown whether the newer version of the vaccine (Shingrix) may have a similar or greater impact on dementia, the researchers said.

- **'Profound Implications'**
- “Although it is still unclear precisely how herpes zoster vaccination lowers the risk of dementia, the implications of the study are profound,” Anupam Jena, MD, PhD, with Harvard Medical School and Massachusetts General Hospital, Boston, wrote in a *Nature* News & Views.
- “The vaccine could represent a cost-effective intervention that has public health benefits strongly exceeding its intended purpose. Given the substantial economic and social burden of dementia, policymakers and health-care providers might need to reassess the value of widespread herpes zoster vaccination, particularly in older adults,” Jena added.
- Reached for comment, Courtney M. Kloske, PhD, Alzheimer’s Association director of scientific engagement, noted that the study supports research presented at the Alzheimer’s Association International Conference in 2020, which showed that flu and pneumonia vaccinations — especially multiple vaccinations over time — were associated with a lower risk for Alzheimer's disease, as previously reported by *Medscape Medical News*.
- “This new study adds to our current knowledge by suggesting the shingles vaccine may also reduce someone's risk of developing dementia,” Kloske said.
- “These new results, while preliminary, call for further studies in large, diverse study populations to inform public health strategy regarding whether vaccinations can decrease our risk of developing dementia as we age,” Kloske added.
- “Big picture,” said Kloske, “these studies emphasize the importance of taking care of your overall health and highlight how important it can be in reducing the long-term risk of developing dementia.”
- *The study received funding from The Phil & Penny Knight Initiative for Brain Resilience, the National Institute on Aging, the National Institute of Allergy and Infectious Diseases, and Chan Zuckerberg Biohub. Geldsetzer, Jena, and Kloske reported no relevant disclosures.*

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NHS rolls out 5-minute ‘super-jab’ for 15 cancers

30 April 2025

Cancer

Thousands of patients will benefit from a new cancer jab for more than a dozen types of the disease, with the NHS the first in Europe to offer the new injection.

The health service is rolling out an injectable form of immunotherapy, nivolumab, which means patients can receive their fortnightly or monthly treatment in 5 minutes instead of up to an hour via an IV drip.

The roll-out will save over a year's worth of treatment time for patients and NHS teams annually – enabling patients to spend less time in hospital while freeing up staff capacity to deliver more appointments and treatments.

The new jab can be used to treat 15 cancer types, including skin cancer, bladder, and oesophagus, and it is estimated around 1,200 patients in England per month could benefit.

This follows approval from the UK's medicines regulator, the Medicines and Healthcare products Regulatory Agency (MHRA) today.

In clinical trials, patients were highly satisfied with the under-the-skin injection, which takes 3-5 minutes to administer, and preferred it to the IV form of the drug which takes 30 to 60 minutes every 2 weeks or four weeks, depending on the cancer type.

Around 2 in 5 patients who currently receive IV nivolumab, which is one of the most widely used cancer treatments, should be eligible for the new jab.

NHS staff administering the jab could save around 1,000 hours of treatment time for patients and clinicians every month – the equivalent of more than 1 full year of time annually.

Most eligible new patients are also expected to begin on the injectable form of nivolumab.

NHS cancer services will now be preparing to treat the first patients with the new treatment next month when supplies of the product are received in the UK, helping to free up valuable resources in nursing and pharmacy teams, as well as helping with capacity demands in cancer day units, where the drug is currently administered.

This is the latest in a series of NHS cancer treatment innovations introduced to save patients time and improve access, including the rollout of new injections for breast cancer, multiple sclerosis, and blood disorders.

Professor Peter Johnson, NHS England National Clinical Director for Cancer said: "Immunotherapy has already been a huge step forward for many NHS patients with cancer, and being able to offer it as an injection in minutes means we can make the process far more convenient.

This treatment is used for 15 different types of the disease, so it will free up thousands of valuable clinicians' time every year, allowing teams to treat even more patients and helping hospital capacity.

And this is just the latest development in the NHS's ongoing commitment to provide patients with the latest cancer therapies and treatment options that truly transform lives".

Minister for Public Health and Prevention Ashley Dalton said: "Britain is a hotbed of innovation, masterminding the newest tech and medical inventions to help people navigating illness. A new jab that fastens up cancer treatment is a prime example of this, so it's fantastic to see cancer patients in England will be among the first in Europe to benefit.

With cancer medicines getting better all the time, this government will ensure that NHS patients are among the first to access the latest treatments and technology.

Our National Cancer Plan will transform the way we approach this disease, improving care and bringing this country's cancer survival rates back up to the standards of the best in the world".

The faster treatment comes at no extra cost to the NHS thanks to an agreement negotiated by NHS England with the manufacturer Bristol Myers Squibb.

James Richardson, Clinical Pharmacist and National Specialty Adviser for Cancer Drugs said: "I am delighted that NHS patients across England will soon be able to benefit from this quicker-to-administer, effective treatment, that can be used to treat a range of cancer types, including skin cancer and solid tumours originating in the kidneys. This is a significant advancement in cancer treatment, with the potential to improve the lives of thousands of patients each month".

Elizabeth O'Mahony, NHS England Chief Financial Officer said: "This is fantastic news for patients – reducing treatment times from an hour to just minutes is a huge boost for people going through cancer care, helping them to spend less time in hospital.

It's also a major win for the NHS, saving the equivalent of a year's worth of treatment time which can be used to deliver other care, building on the great strides made in the past 6 months, and thanks to a deal struck by NHS England this quick treatment will be available without any additional cost".

The rollout forms part of NHS England's 3-pillar approach to delivering the best value from medicines – combining cutting-edge innovations such as a potential cure for sickle cell and life-changing cystic fibrosis drugs; smarter use of biosimilars and generics delivering hundreds of millions in annual savings; and new treatments like this that free up clinical capacity and improve patient experience.

ELSEVIER

Computerized Medical Imaging and Graphics

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A deep learning approach for virtual contrast enhancement in Contrast Enhanced Spectral Mammography

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Abstract

- Contrast Enhanced Spectral Mammography (CESM) is a dual-energy mammographic imaging technique that first requires intravenously administering an iodinated contrast medium. Then, it collects both a low-energy image, comparable to standard mammography, and a high-energy image. The two scans are combined to get a recombined image showing contrast enhancement. Despite CESM diagnostic advantages for breast cancer diagnosis, the use of contrast medium can cause side effects, and CESM also beams patients with a higher radiation dose compared to standard mammography. To address these limitations, this work proposes using deep generative models for virtual contrast enhancement on CESM, aiming to make CESM contrast-free and reduce the radiation dose. Our deep networks, consisting of an autoencoder and two Generative Adversarial Networks, the Pix2Pix, and the CycleGAN, generate synthetic recombined images solely from low-energy images. We perform an extensive quantitative and qualitative analysis of the model's performance, also exploiting radiologists' assessments, on a novel CESM dataset that includes 1138 images. As a further contribution to this work, we make the dataset publicly available. The results show that CycleGAN is the most promising deep network to generate synthetic recombined images, highlighting the potential of artificial intelligence techniques for virtual contrast enhancement in this field.

Introduction

ontrast-Enhanced Spectral Mammography (CESM) is a dual-energy breast imaging technique classified as a level II breast diagnostic. Unlike standard mammography, so referred to as full-field digital mammography (FFDM), CESM involves the injection of an iodinated contrast medium that diffuses into the tumor tissue, enhancing sion visibility (Jochelson and Lobbes, 2021). This results in improved diagnostic accuracy, especially in patients with heterogeneously dense and extremely dense reast tissue, which in FFDM may obscure small masses and reduce sensitivity (James and Tennant, 2018). Furthermore, CESM is a valid alternative to contrast-nhanced breast magnetic resonance imaging (MRI), being more specific, accessible, cheaper, and preferred by patients (James and Tennant, 2018). During CESM, both reasts undergo compression in craniocaudal and mediolateral oblique projections, capturing low-energy (LE) and high-energy (HE) images in rapid succession post-ontrast injection. The LE image is comparable with FFDM and is combined with the HE image through post-processing to generate a dual-energy subtracted (DES) mage in which areas of lesion contrast enhancement are highlighted (Jochelson and Lobbes, 2021). However, despite its benefits, the widespread adoption of CESM ay be limited by two issues: (I) the administration of iodinated contrast medium carries risks of adverse reactions, including hypersensitivity reactions and contrast-duced nephropathy (CIN); (II) CESM entails a higher radiation dose compared to FFDM due to the dual-energy exposure for each projection (Patel et al., 2018).

promising solution to address these limitations is to leverage Artificial Intelligence (AI) techniques, particularly Deep Learning (DL). Recent advancements in DL ave facilitated Image-to-Image translation tasks in medical imaging, including Virtual Contrast Enhancement (VCE), which involves generating synthetic contrast-nhanced images from non-contrast images. While previous studies have explored VCE for MRI (Kleesiek et al., 2019) and computed tomography (CT) images (Choi e ., 2021, Xie et al., 2021), the application of this approach to CESM remains unexplored. The use of DL techniques to perform VCE on CESM would involve nvestigating the synthesis of DES images directly from LE images. Given the equivalence between LE images and FFDM images, as supported in Francescone et al. 2014), this approach would offer three significant benefits. First, it may eliminate the necessity of administering contrast medium, that may have adverse reaction. econd, it may reduce patient radiation exposure since the HE image would not need to be acquired. Third, employing AI models to generate DES images from LE mages may significantly reduce waiting times, costs, and stress when a patient has already undergone FFDM, but CESM is further needed for the diagnosis, treatment, r intervention.

hus, as depicted in Fig. 1, our goal is to investigate if AI can be used as a possible tool for VCE on CESM, by training and validating established DL models. As part o ur efforts to advance research in the CESM field, we release the dataset collected and used in this study. This marks a significant milestone, as it is the first publicly vailable CESM dataset in DICOM format, with data anonymized to ensure privacy. The dataset consists of 1138 images in DICOM format, comprising 569 LE and 56 ES images, collected from 105 patients. All relevant non-sensitive DICOM tags are accessible, and the dataset includes information extracted from medical reports an iopsy records. Furthermore, to ensure the reproducibility of our experiments in support of research, we have decided to make our code public.[2]

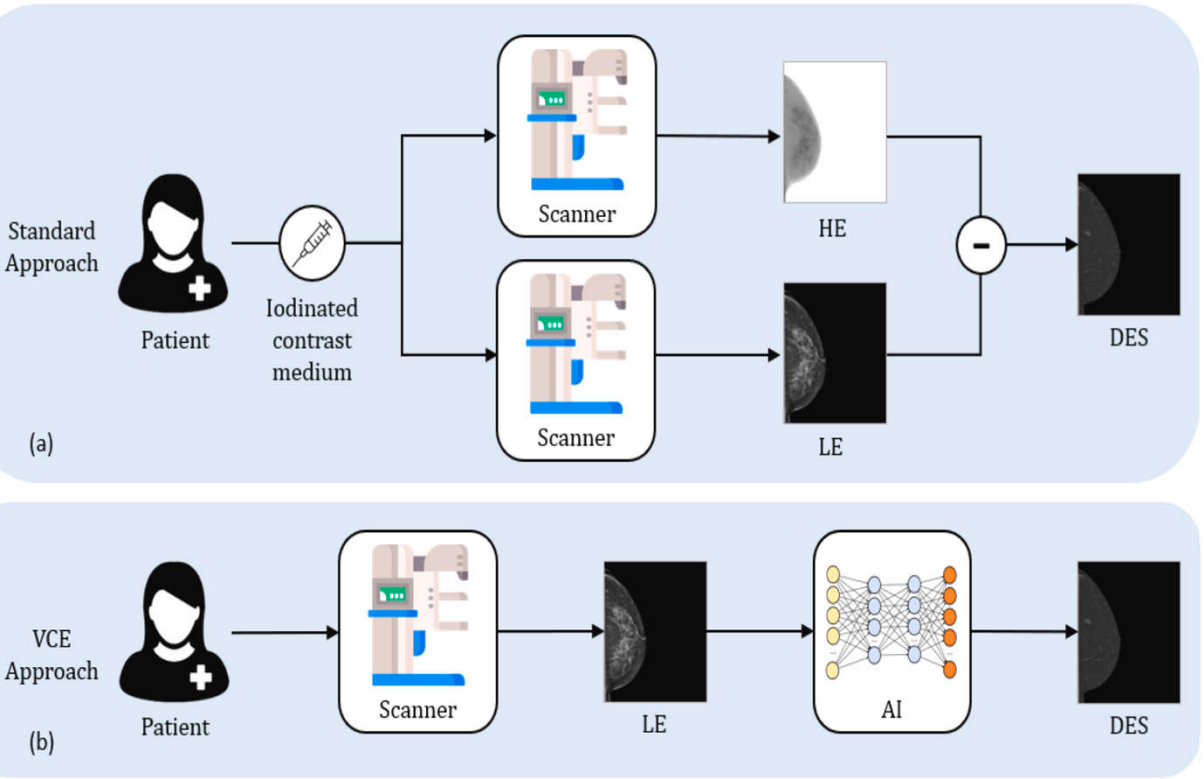


Fig. 1. Illustration of DES images generation. (a) Standard approach with DES image obtained by injecting iodinated contras medium into the patient and acquiring both the LE and HE images. (b) VCE approach proposed by our work, with DES images generated directly from the LE images, without the need t inject iodinated contrast medium or acquire HE images.

••Present an evaluation of three state-of-the-art DL models in executing the novel task of VCE for CESM images. Through quantitative and qualitative assessments, we aim to define the baseline performance for this specific task;

••Release of the first dataset of CESM examination images in DICOM format, complete with information from medical reports and biopsies;

••Release of code used in our experiments.

The rest of the manuscript is organized as follows:
Section 2 presents the background of the study. Section 3 outlines the publicly released dataset used for the study. Section 4 propose the methods used, including neural network architectures, image pre-processing, and the training and evaluation process.
Section 5 presents and discusses the results obtained, while Section 6 offers our conclusions.

2. Background

In this Section, we describe the CESM technique, highlighting its growing relevance in clinical applications, while also addressing the limitations that could impede its widespread adoption in the clinical setting. Additionally, we delve into the current advancements in image-to-image translation for VCE across diverse medical imaging modalities, pivotal to our investigation into its application to CESM images in our study.

2.1. CESM technique

The CESM technique involves compressing both breasts in craniocaudal and mediolateral oblique projections for approximately two minutes after contrast medium injection. During each compression, a LE and HE image are acquired in quick succession, and the exam is completed within 10 min of the start of contrast administration. The LE image is acquired below the K-edge of iodine (33.2 keV). Thus, as supported in Francescone et al. (2014), it is blind to iodine and comparable to FFDM, despite the presence of iodinated contrast medium in the breast. Conversely, the HE image is acquired above the K-edge of iodine, and it is not suitable for diagnostic purposes on its own. However, employing logarithmic subtraction in post-processing, it is combined with the LE image to obtain the recombined image or DES image. This DES image suppresses parenchymal tissue, revealing only areas of contrast enhancement, thereby enhancing lesion visibility and improving diagnostic accuracy. Thus, CESM provides radiologists with LE and DES image pairs for diagnosis (Jochelson and Lobbes, 2021).

2.2. CESM clinical applications

Because of its characteristics, CESM can be used in several clinical scenarios. It serves as a valuable tool in high-risk screening, further evaluation of extremely dense breast tissue, diagnostic assessment of suspicious lesions, breast cancer staging, surgical planning, and assessment of treatment response (Bhimani et al., 2017). In particular, CESM is a successful digital breast imaging method for planning surgery since it provides a clear map of the lesion extent and its relation to other structures. In this context, it has been demonstrated that CESM led to a significant improvement in detecting multifocal-multicentric cancers compared to FFDM. This capability is essential to determine the methods of surgical treatment for the patients, leading CESM to have a crucial influence on surgical decision (Lorek et al., 2021). CESM also plays a crucial role in evaluating the response to neoadjuvant chemotherapy, which is the standard treatment for locally advanced breast carcinomas. Accurate assessment of this response is fundamental to increase the chances of successful breast-conserving surgery and to avoid local recurrence (Elkassas et al., 2022). It has been demonstrated that CESM is as reliable as MRI in assessing the response to neoadjuvant chemotherapy and may be an alternative when MRI is contraindicated or its availability is limited (Iotti et al., 2017). Furthermore, CESM-guided biopsy has emerged as a promising technique, offering a viable alternative to MRI-guided breast biopsy. Recent studies have showcased its efficacy, demonstrating that CESM-guided biopsy is well tolerated by patients and feasible due to its fast execution and high success rates (Sammarra et al., 2024, James, 2022).

.3. CESM limitations

wo factors may limit the adoption of CESM as a widespread screening technique. First, although the administration of iodinated contrast medium is essential for the performance of CESM, dverse effects may occur, such as hypersensitivity reactions and the possibility of CIN (Pasternak and Williamson, 2012). The estimated incidence of hypersensitivity reactions ranges from 0.7% o 3.1%, with severe reactions occurring in only 0.02% to 0.04% of administrations (Patel et al., 2018). CIN is defined as a decline in renal function within three days of iodine-based contrast nedium administration. Its pathophysiology remains poorly understood, but pre-existing renal dysfunction appears to contribute (Zamora et al., 2021). Second, CESM requires a double energy xposure for each projection, i.e., it collects both the LE and HE images, resulting in a higher radiation dose compared to FFDM (Patel et al., 2018). To overcome these limitations, reducing the dministration of the contrast medium and the amount of radiation using AI techniques is a viable solution that can now be investigated, thanks to the recent progress in DL and generative pproaches, in particular.

.4. Image-to-image translation for virtual contrast enhancement

n recent years, the use of deep neural networks has become dominant in image-to-image translation for medical images (Kaji and Kida, 2019). Image-to-image translation involves converting mages from the source domain X to the target domain Y. This approach is implemented in medical image analysis, including tasks such as noise reduction (Yang et al., 2017), super-resolution Umehara et al., 2018), cross-modality synthesis (Liu et al., 2021a), and VCE, which is the goal of our work. Previous studies have explored the application of deep neural networks in VCE for MRI and CT images. The aim was to generate synthetic contrast-enhanced images from non-contrast images, with the goal of evaluating the feasibility of reducing contrast media usage while reserving image quality. In this context, Kleesiek et al. (2019) trained a fully convolutional autoencoder with dropout to predict contrast enhancement from non-contrast nultiparametric brain MRI scans, with 10 channels used for the model input. Choi et al. (2021) evaluated the 3D implementation of Pix2Pix for generating synthetic contrast-enhanced hest CT from non-contrast chest CT. Xie et al. (2021) exploited a cycle-consistent generative adversarial network (CycleGAN) framework to learn a mapping from non-contrast CT to contrast-nhanced CT, using a residual U-Net as the generator of the CycleGAN.

lowever, no one has yet analyzed VCE within the context of CESM. Nonetheless, we firmly believe that investigating this approach is a valid solution to overcome the use of contrast media and educe exposure to dual energy.

. Materials

n this work, we collected and utilized an in-house dataset, named CESM@UCBM in the following, which we make publicly available[3] after anonymizing sensitive data. The images are stored in DICOM format, thus including imaging parameters, acquisition details, and annotations, which are useful for the analyses.

Table 3.1 summarizes the main characteristics of the dataset. It consists of 1138 images, divided into 569 LE images and 569 DES images. These images were obtained from 105 patients aged etween 31 and 90 years, with an average age of 57.4 years and a standard deviation of 11.5 years. They were enrolled in the study under the Ethical Committee approval PAR 51.23 OSS. All the xams were performed at the Fondazione Policlinico Universitario Campus Bio-Medico in Rome between September 2021 and October 2022, using the Senographe Pristina digital nammography (GE Healthcare). The size of 984 images is 2850 × 2396 pixels, while the remaining 154 images have a size of 2294 × 1916 pixels. Among the 1138 images in the CESM@UCBM ataset:

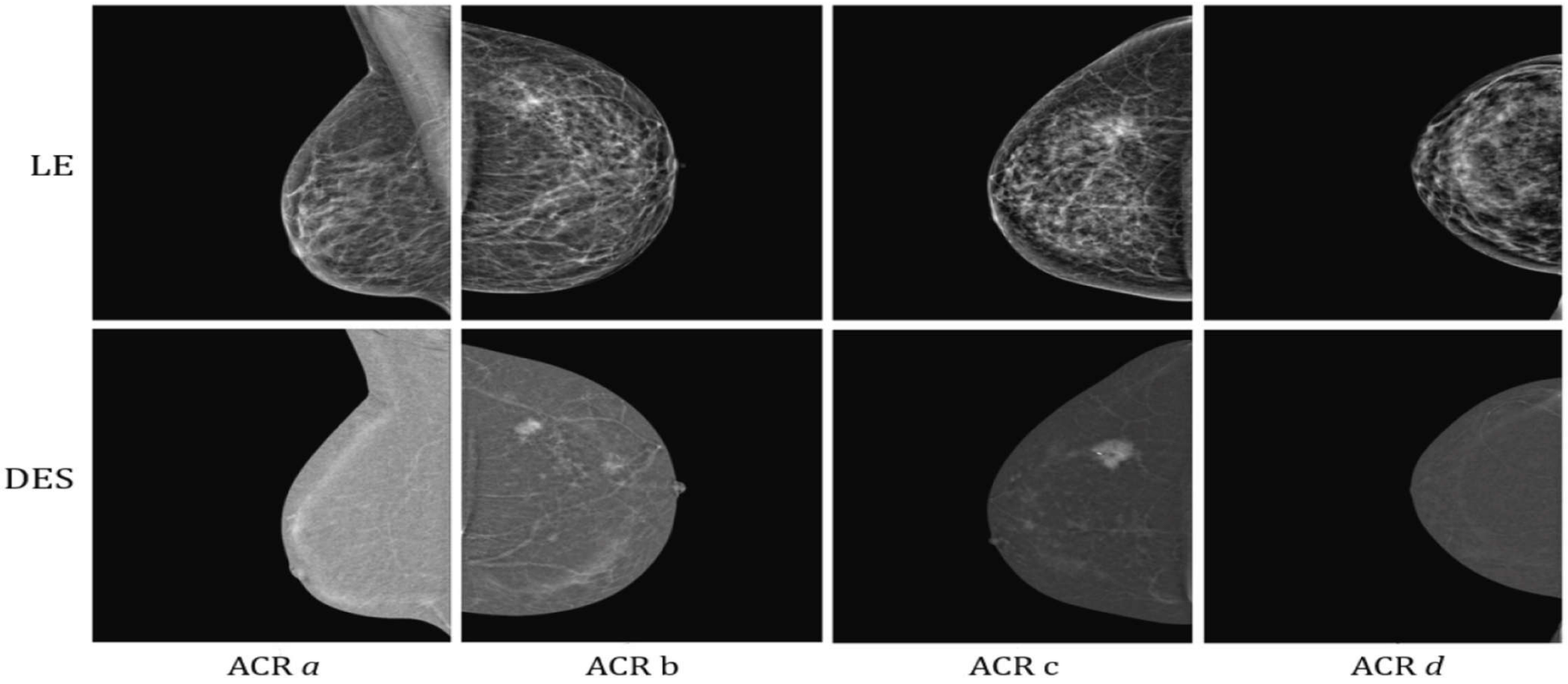
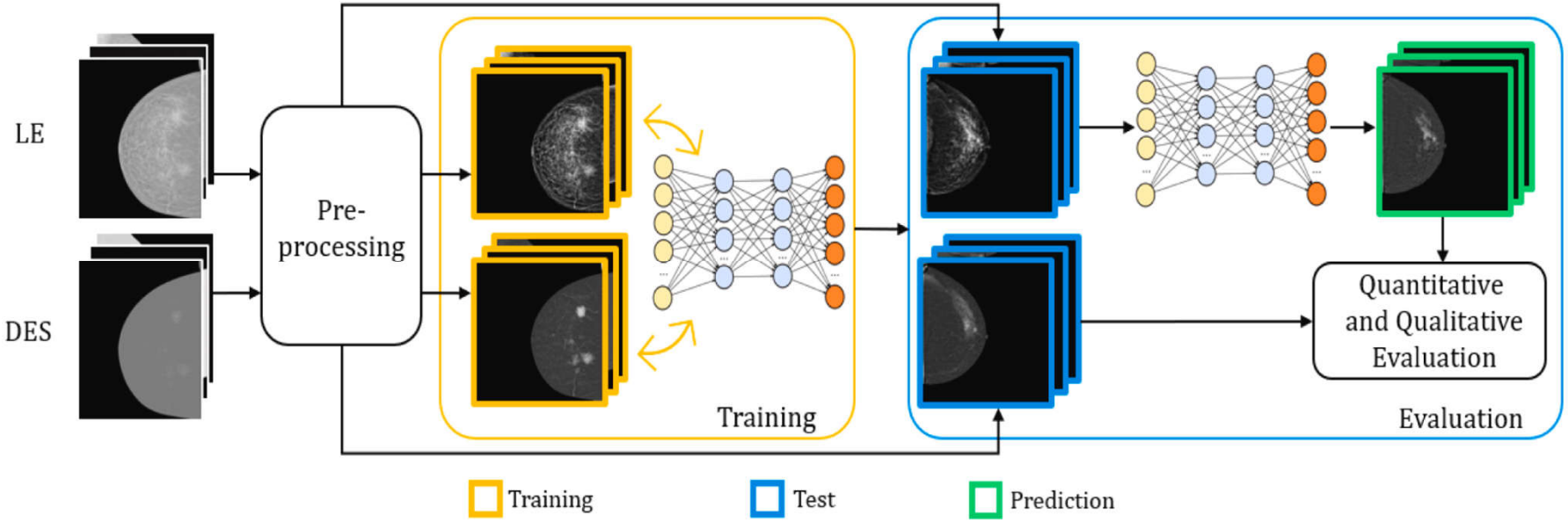


Fig. 2. From left to right, pairs of LE (above) and DES images (below) from the CESM@UCBM dataset with ACR categories *a*, *b*, *c*, *d*.

4. Methods

We design the VCE task on CESM images as an image-to-image translation problem, where the source domain X consists of LE images, and the target domain Y consists of DES images. Considering x as a generic LE image from X, and y as the corresponding DES image from Y, we implement DL models G that take x as input and attempt to generate the corresponding virtual contrast-enhanced DES images, i.e., $\hat{y}=G(x)$, minimizing the distance between $\hat{y}$ and y.

A schematic representation of the methods is shown in Fig. 3 and, accordingly, in this Section, we present the image pre-processing, the AI models, and the training and



4.1. Pre-processing

To ensure that data are consistent and homogeneous, we first applied zero-padding to make images squared, second we applied contrast stretching to adjust the brightness of the images, third we normalized the pixel values bringing them in the range [0,1], and fourth we resized the images to 256 × 256.

4.2. AI models

The AI models used in this work to perform the VCE task on CESM images are an autoencoder and two GANs, the Pix2Pix (Isola et al., 2017) and the CycleGAN (Zhu et al., 2017), since these networks have accelerated the use of deep neural networks in image-to-image translation (Kaji and Kida, 2019) and are consistent with the state of the art of VCE, as reported in Section 2.4. Representative diagrams of the architectures used are in Fig. 4.

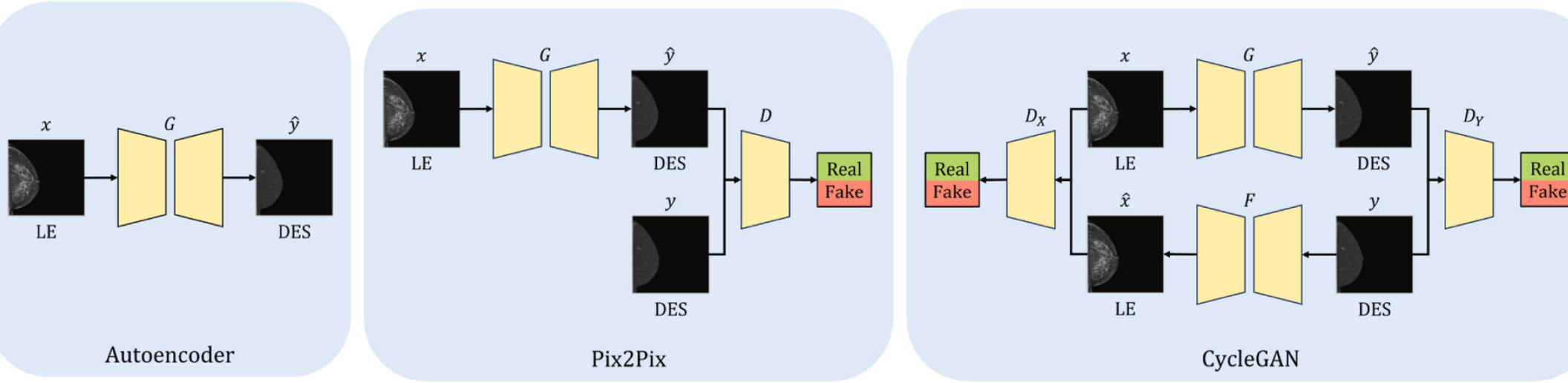


Fig. 4. Representative diagrams of Autoencoder, Pix2Pix and CycleGAN translating from LE to DES images. Symbols: x is the input image, yˆ is the output image, y is the target image, G and F are the generators, D are the discriminators.

Results and discussion

In this Section, we present and discuss the results obtained from the quantitative and the qualitative evaluations, conducted as described in Sections 4.4 Quantitative evaluation, 4.5 Qualitative evaluation, respectively. Given that this is the first time AI is being utilized to execute VCE on CESM images, we establish these results as the b

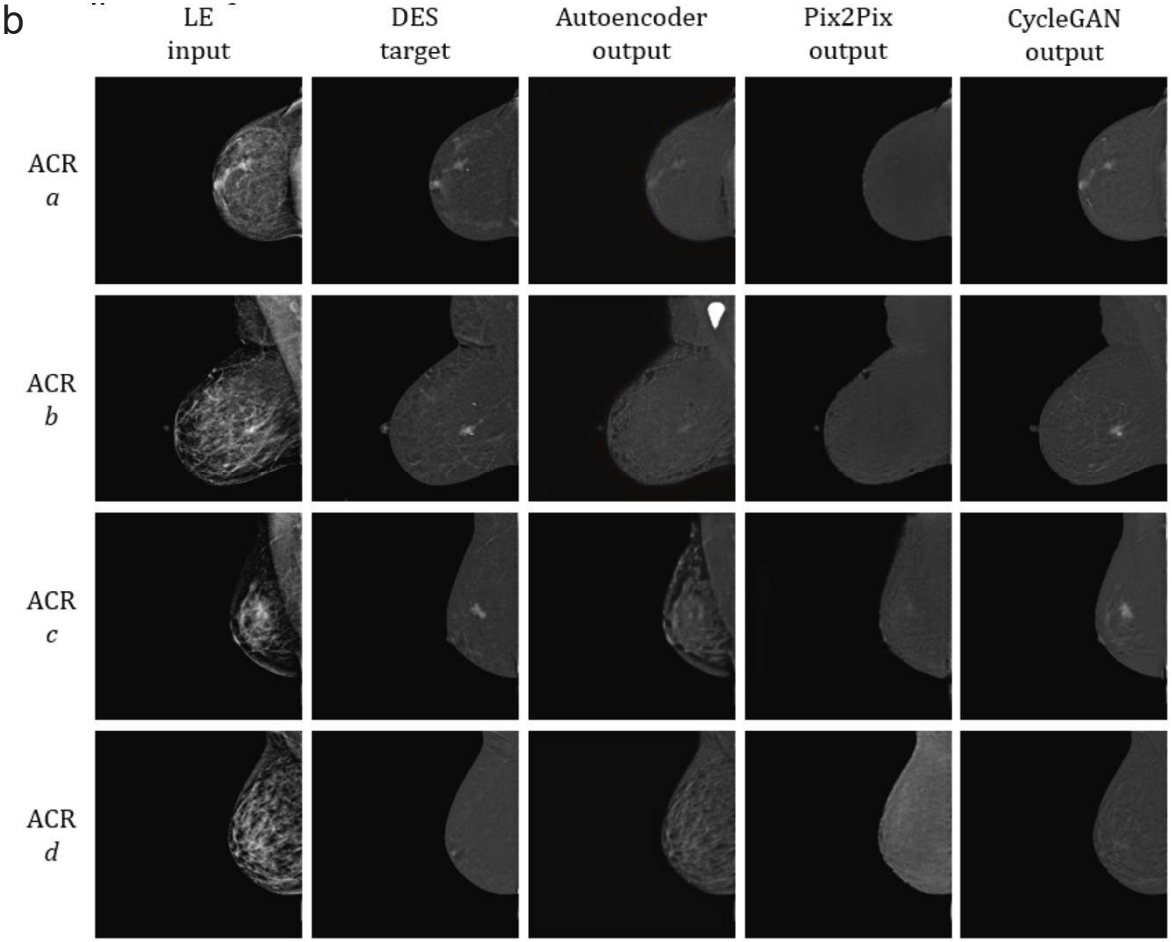
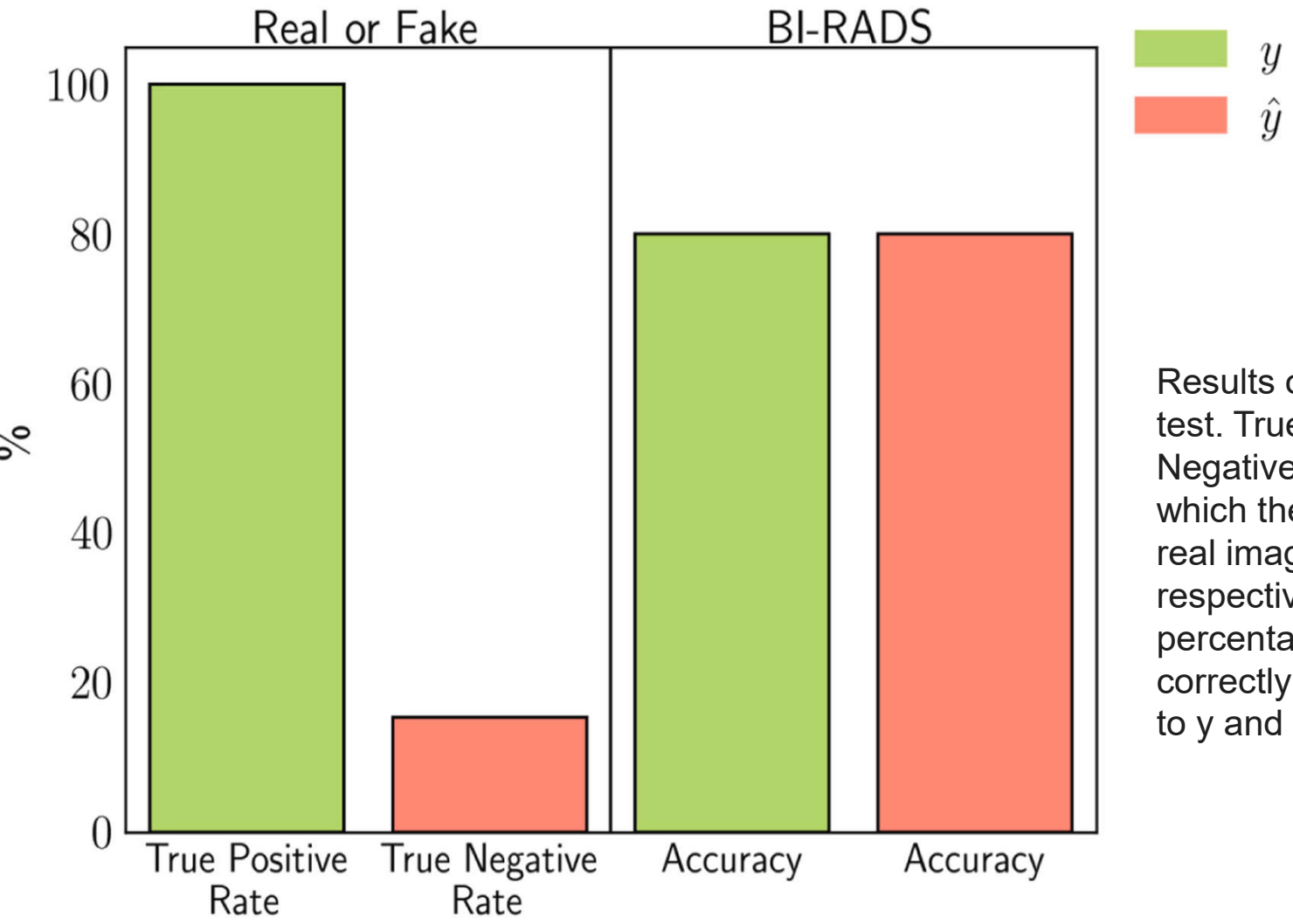


Fig. 5. Four representative cases of LE input images, DES target images, and output images of Autoencoder, Pix2Pix, and CycleGAN (from left to right) varying the ACR category (from top to bottom).



Results of the second visual Turing test. True Positive Rate and True Negative Rate are the percentages at which the radiologists correctly label real images y and synthetic images yˆ, respectively. The Accuracy is the percentage at which the radiologists correctly assign the BI-RADS score to y and yˆ.

Conclusions

CESM is a breast imaging technique that produces LE images, similar to FFDM, and DES images where a tumor lesion can be easily seen thanks to an injected iodine contrast medium. In this context, our work offers two contributions. First, this study has demonstrated that VCE can be applied to CESM images avoiding the need for contrast medium administration and minimizing radiation exposure. This claim is supported by experiments using three well-established generative deep models, namely an autoencoder, Pix2Pix, and CycleGAN, which generate DES images solely from LE images. The quantitative analysis results, pertaining to the computation of evaluation metrics, highlighted the inferiority of the autoencoder's performance compared to Pix2Pix and CycleGAN, but not a clear difference between the two. Conversely, the qualitative analysis findings, derived from visual Turing tests administered to four expert radiologists, underscored that CycleGAN provides the best-quality synthetic images, which are often hard to distinguish from real images, even for radiologists. Furthermore, the qualitative results suggest that BI-RADS scores can be assigned from CycleGAN-generated images with an accuracy equal to using real images.

Second, we have presented and made publicly accessible a unique dataset of CESM images. We have taken great care to ensure the dataset's value to the scientific community by including data extracted from the medical reports and from the biopsies, together with DICOM images. This offers image information available in the DICOM tags, which would not be accessible in JPEG format as is the case of the other CESM public dataset (Khaled et al., 2022). We hope that our dataset provides all the necessary information for conducting CESM analyses, and we extend an invitation to the scientific community to delve deeper into this area.

Despite these promising findings, the way to the clinical adoption of VCE technology in clinical practice needs further research and validation, including the development of custom deep architectures that optimize previous ones and the incorporation of loss functions that prioritize lesion reconstruction during training. We are working to enlarge the dataset and to set up external validation involving other centers. Furthermore, while here we have generated full-dose DES images from LE images that simulate images with zero-dose contrast medium, we deem that it would be interesting to implement models producing full-dose DES images from low-dose DES images as this approach holds the potential for even more improved outcomes.

CRediT authorship contribution statement

Aurora Rofena: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. Valerio Guarrasi: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. Marina Sarli: Data curation, Resources. Claudia Lucia Piccolo: Conceptualization, Resources. Matteo Sammarra: Conceptualization, Resources. Bruno Beomonte Zobel: Conceptualization, Resources. Paolo Soda: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing – review & editing

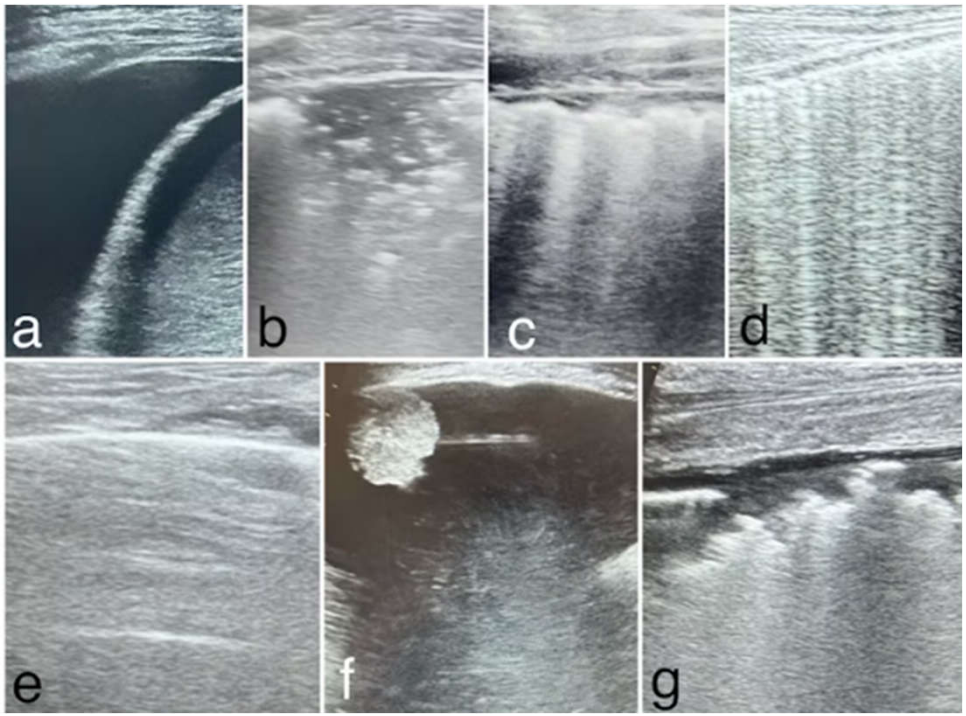
CLINICAL NEWS | ULTRASOUND

Lung POCUS helps diagnose dyspnea in emergency departments

Amerigo Allegretto

Apr 23, 2025

- Point-of-care lung ultrasound (lung POCUS) may be useful in the emergency department for diagnosing dyspnea, according to a study published April 22 in *Emergency Radiology*.
- Researchers led by Adi-Ionut Ciumanghel, PhD**,** from the Clinical Emergency County Hospital in Iași, Romania, found that emergency physicians used lung POCUS well for detecting symptoms of dyspnea and completed scans at shorter times than attending physicians.
- "Given its availability, [lung POCUS] is a useful tool for the assessment of patients presenting with dyspnea," Ciumanghel and colleagues wrote.
- Acute dyspnea – or sudden shortness of breath – is a symptom that commonly presents in the emergency department and could indicate a variety of pulmonary or cardiac diseases. A rapid and accurate diagnosis can guide timely and appropriate care for patients.
- Ciumanghel et al wrote that their department began using lung POCUS due to their hospital's emergency department being overcrowded and their radiology department being overwhelmed by high x-ray and CT scanning volumes. They highlighted that lung POCUS can identify causes of acute dyspnea, improve patient flows in the emergency department, and prevent expensive imaging tests that may use radiation.
- The team studied the concordance between emergency physician diagnosis via lung POCUS and attending physician diagnosis (which includes lab tests, CT scans, and specialist assessments) in patients presenting with dyspnea.
- The study included prospective data collected between 2022 and 2024 from 103 emergency department patients with an average age of 70. The team included dyspneic patients who presented when the physician involved in the study was on call.



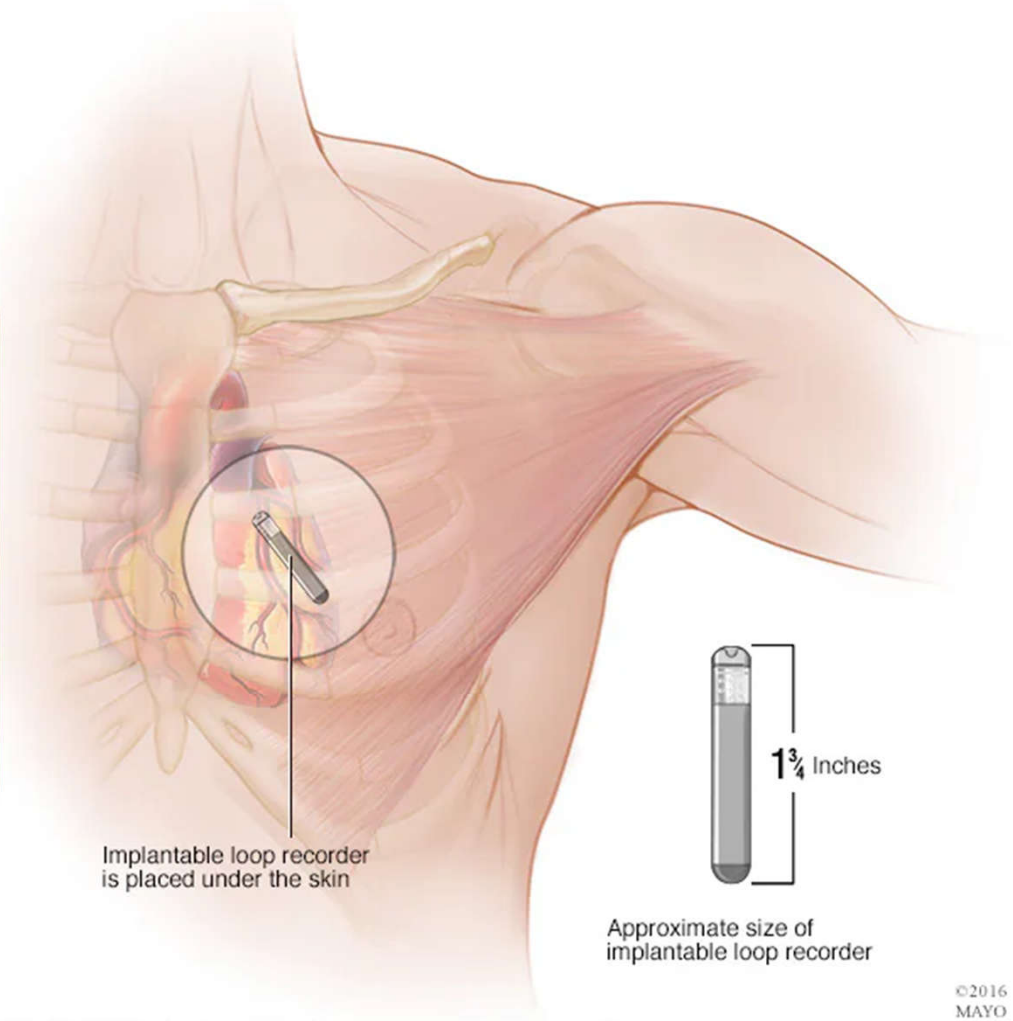
Images show lung ultrasound findings of major pleuro-pulmonary pathologies. (a) Pleural effusion; (b) Pneumonia; (c) Bronchopneumonia; (d) Acute pulmonary edema; (e) Chronic obstructive pulmonary disease exacerbation; (f) Pleuropulmonary tumors; (g) Acute respiratory distress syndrome.

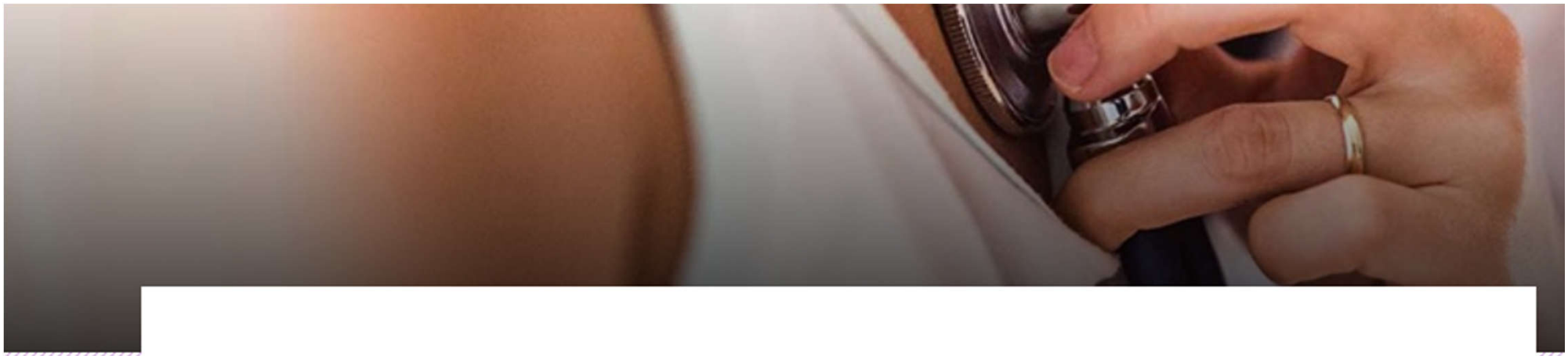
The group also used Cohen's kappa coefficient for measuring agreement between emergency and attending physicians. Both physicians showed excellent agreement in diagnosing the following causes of acute dyspnea: pleural effusion ($\kappa = 1$ for bilateral, 0.844 for right, 0.79 for left pleural effusion), pneumonia ($\kappa = 0.979$ for right, 0.93 for left), bronchopneumonia ($\kappa = 0.912$), acute pulmonary edema ($\kappa = 1$), chronic obstructive pulmonary disease exacerbation ($\kappa = 0.904$), pleuropulmonary tumors ($k = 0.884$), and acute respiratory distress syndrome ($\kappa = 1$). All the results were statistically significant ($p < 0.001$).

Emergency physicians took a median time of 16 minutes to complete scans with lung POCUS compared to the median 480 minutes needed for diagnosis by attending physicians.

The study authors highlighted that lung POCUS could inform strategies for high-volume emergency departments that experience delays in diagnosis. They added that the modality could be useful in imaging patients who are too unstable to be transported to the radiology department.

"For these patients [lung POCUS] has the advantage of being available at bedside, decreasing the risks associated with transport," the authors wrote. "Also, there is a negligible cost of each individual … examination."





Loop Recorder Implantation

Cardiovascular

- What is loop recorder implantation?
- An implantable loop recorder (ILR) is a heart recording device. It's implanted in the body under the chest skin. It has several uses. The most common ones include looking for causes of fainting, palpitations, very fast or slow heartbeats, and hidden rhythms that can cause strokes. Loop recorder implantation is considered a minor procedure. For the procedure, your heart healthcare provider (cardiologist) places the small device under your skin, in your chest wall, overlying the heart. The machine works as an electrocardiogram (ECG). It constantly picks up electrical signals from your heart and records anything abnormal. This can help identify heart rhythms that can cause problems, such as fainting.
- Normally, a special group of cells initiate the electrical signal to start your heartbeat. These cells are in the sinoatrial node. This node is in the upper right chamber of your heart (right atrium). The signal quickly travels down your heart’s conducting system to the ventricles. These are the two lower chambers of your heart. As it travels, the signal sets off nearby parts of your heart to contract. This helps your heart pump blood in a coordinated way.
- Any disruptions to this signaling pathway may result in heart rhythm problems. These might cause problems, such as fainting and palpitations. An abnormal heart rhythm (arrhythmia) may make your heart unable to pump as much blood as needed. If blood flow to your brain is reduced for a short time, you may faint. When the rhythm returns to normal, blood flow is restored and you normally regain consciousness.
- An implantable loop recorder constantly records information about your electrical activity, similar to an ECG. But an ILR can record heart rhythm for up to 3 years. This is particularly useful if your arrhythmia doesn't occur often. An ILR is constantly looping its memory. And it has automatic triggers to store recordings. It can also be patient-activated to store recordings as well. If you fainted due to an arrhythmia, the machine records this information before, during, and after the fainting. Then a healthcare provider can look at the recordings to figure out the cause. Most current ILRs have a home monitor that can send data to your healthcare provider.

- Why might I need loop recorder implantation?
- You might need an ILR if you have fainting episodes or palpitations, and other tests haven't yet given you any answers. Each heart rhythm problem may need its own treatment. It’s important to find out what kind of problem you may have, if any. Repeated fainting can have a negative effect on your physical and emotional health. Also some kinds of fainting greatly increase your chance for sudden death. These fainting episodes need diagnosis and treatment as soon as possible. Once you're diagnosed, you may need a pacemaker or an implantable cardioverter-defibrillator. These could save your life. You might also need a loop recorder if your healthcare provider wants to look for very fast or slow heartbeats. These abnormal heartbeats can cause palpitations or even lead to strokes.
- Loop recorder implantation is often helpful if other tests haven’t found the cause. Your healthcare provider is more likely to advise it if your heart rhythm is a likely cause of your fainting. This is more common in older adults. It's also more common in people with other heart problems. You're also more likely to need loop recorder implantation if you are fainting often, but not enough for other kinds of heart rhythm monitoring to find your fainting. The loop recorder records for up to 3 years. So over time your provider should be able to analyze your heart rhythms during a fainting episode.
- You also might need a loop recorder if you're an older adult with unexplained falls. Or if you've had a stroke without a clear reason. Sometimes arrhythmias are responsible for these conditions. Healthcare providers sometimes use it in people believed to have epilepsy who haven't responded to medicine. In each case, the recorder can figure out if an abnormal rhythm is the problem.
- What are the risks of loop recorder implantation?

Most people have the procedure without any problems. But sometimes problems happen. These might include:

- Bleeding or bruising
- Infection (might require device removal)
- Mild pain at your implantation site

Your own risks will depend on your age, your other health conditions, and other factors. Ask your healthcare provider about any risks of the procedure for you.

- How do I get ready for a loop recorder implantation?

Talk with your healthcare provider about what you should do to get ready for your procedure. Follow any directions you're given for not eating or drinking before your procedure. Follow your provider's instructions about what medicines to take before the procedure. Don't stop taking any medicine unless your provider tells you to do so. You might also need tests before the procedure, such as an ECG

What happens during a loop recorder implantation?

Ask your healthcare provider about what to expect during your procedure. Normally, you can expect the following:

- A local anesthetic will be put on your skin to numb it.
- Your healthcare provider will make a small cut (incision) in your skin. This is often done in the left upper chest.
- Your provider will then inject the device through the cut under the skin. The machine is about the size of a flat AAA battery.
- Your cut will be closed with glue, stitches, or possibly staples. A bandage will be put on the area.

Next steps

Before you agree to the test or procedure make sure you know:

- The name of the test or procedure
- The reason you are having the test or procedure
- What results to expect and what they mean
- The risks and benefits of the test or procedure
- What the possible side effects or complications are
- When and where you are to have the test or procedure
- Who will do the test or procedure and what that person’s qualifications are
- What would happen if you did not have the test or procedure
- Any alternative tests or procedures to think about
- When and how you will get the results
- Who to call after the test or procedure if you have questions or problems
- How much you will have to pay for the test or procedure

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THÔNG BÁO SỐ 1
Tổ chức Hội nghị khoa học Chẩn đoán hình ảnh Nhi khoa 2025

Nhằm tạo điều kiện để các bác sĩ Chẩn đoán hình ảnh và bác sĩ Nhi khoa đang công tác tại các bệnh viện trong cả nước có dịp cập nhật kiến thức, trao đổi thông tin và chia sẻ kinh nghiệm trong lĩnh vực chẩn đoán hình ảnh, Bệnh viện Nhi Đồng 1 phối hợp với Hội Chẩn đoán hình ảnh TP HCM dự kiến tổ chức **Hội nghị khoa học Chẩn đoán hình ảnh Nhi khoa 2025** vào ngày **12/7/2025**.

Chương trình hội nghị sẽ bao gồm các bài báo cáo khoa học của chuyên gia trong các lĩnh vực Chẩn đoán hình ảnh và lâm sàng.

Ban tổ chức **Hội nghị** kính nhờ Ban Giám đốc Quý bệnh viện thông báo đến nhân viên y tế tại đơn vị mình về việc đăng ký báo cáo trong Hội nghị với thông tin chi tiết như sau:

+ Đăng ký thông tin, tóm tắt nội dung bài báo cáo (abstract), lý lịch khoa học (theo mẫu) qua link *https://forms.gle/XiTbpuKytNR7nLaR7* hoặc mã QR đính kèm.

+ Thời hạn nhận đăng ký đến hết ngày **10/6/2025**.

+ Thời hạn nhận bài toàn văn (fulltext theo thể lệ đính kèm) đến hết ngày **30/6/2025**.

+Lưu ý: Các bài báo cáo gửi sớm, nếu phù hợp, sẽ được xem xét ưu tiên xếp vào chương trình báo cáo.

Để công tác chuẩn bị được chu đáo, Quý đồng nghiệp vui lòng đăng ký đầy đủ thông tin. Mọi chi tiết vui lòng liên hệ phòng Chỉ đạo tuyến Bệnh viện Nhi Đồng 1, điện thoại (028) 38 346 242, email: *hoithaokhoahoc.bvnd1@gmail.com*.

Trân trọng kính chào./.

Nơi nhận:
- Bệnh viện có khoa CĐHA, khoa Nhi toàn quốc;
- Bộ môn CĐHA, BMN ĐH Y Dược;
- Hội CĐHA.TPHCM
- Lưu: VT, CĐT (100b).

GIÁM ĐỐC

BỆNH VIỆN NHI ĐỒNG 1

PGS.TS NGUYỄN THANH HÙNG