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Sounding It Out

POCUS is proving useful for the diagnosis and treatment of COVID-19.

REMOTE OUTPOSTS

Remote diagnostics help DR vendors ramp up virtual service support.

SHORING UP THE FRONT LINE

Burnout Prevention for Radiologic Technologists in the Wake of COVID-19

A BRIGHTER FUTURE

Advances in medical display technology offer better contrast and higher resolution.

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A Brighter Future

By **KEITH LORIA**

There have been significant medical display advances in both hardware and software over the past few years, as manufacturers work to ensure radiologists are seeing the finest details in their views.

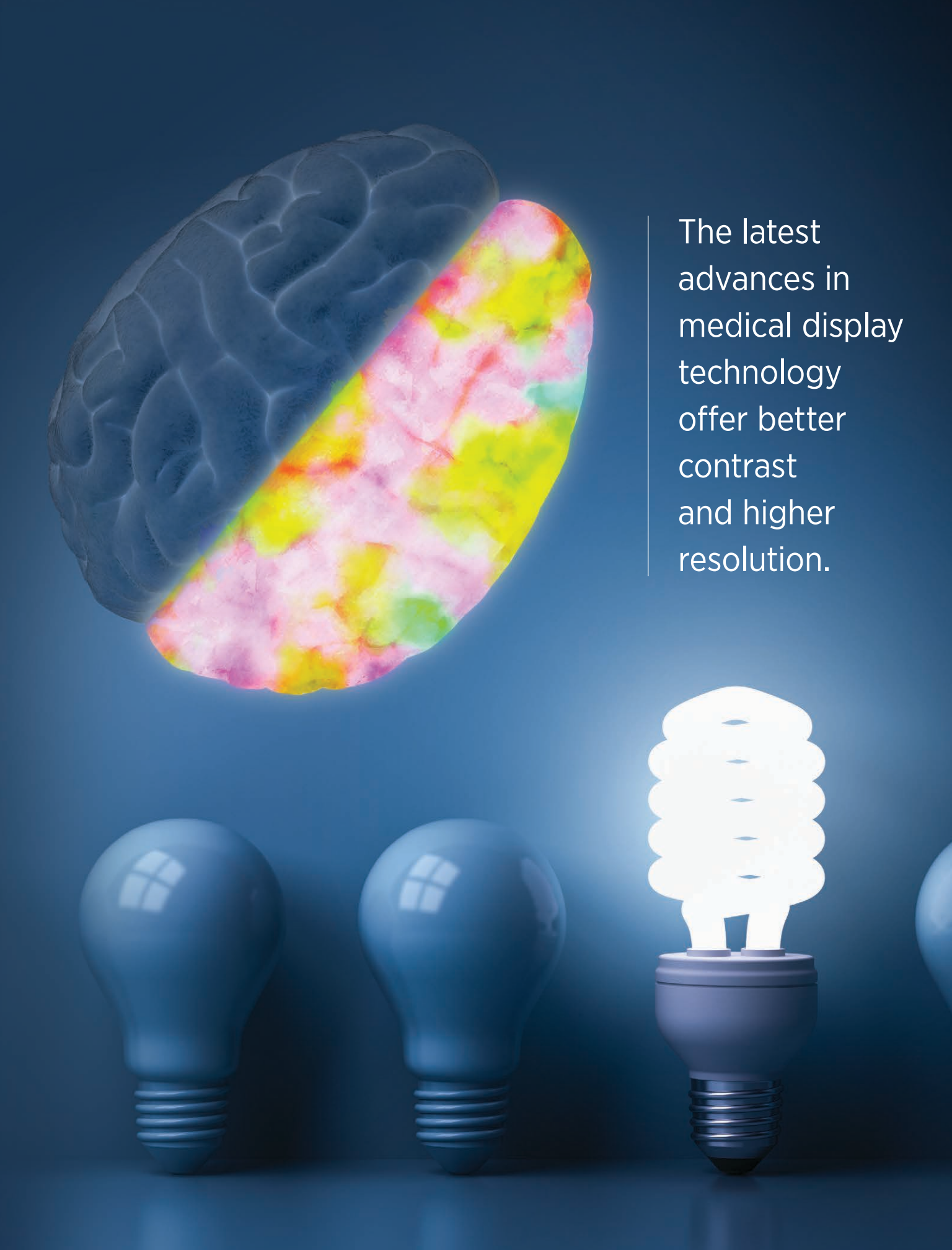
"The technology behind them is ever-changing and advancing to provide the most accurate and consistent medical imaging for radiologists, allowing them to easily identify the correct diagnoses for patients," says Tom Impellizeri, senior account manager in the ID B2B division for LG Electronics. "We are seeing higher-brightness, higher-resolution wide-screen monitors with thinner bezels."

On the hardware side, LED backlit displays are providing higher contrast and brightness levels with longer life and higher resolution. Large-format options in a variety of resolutions are now available for those users wanting one display vs two. Software advances allow more in-depth testing, reporting, and configurable alerting functions.

"Photosensors built into the displays for autocalibration are more accurate and used in conjunction with sophisticated calibration software. Monitor gray levels and colors are calibrated more accurately to much tighter tolerances and enable enterprise management," says Tara Neill, director of sales and marketing for Double Black Imaging. "With the rise of color use in [graphic user interfaces], as well as with multimodality imaging, the market has seen a shift from monochrome to color displays."

As radiologists move into home offices and out of reading rooms, most recently because of COVID-19, it is essential that medical displays meet DICOM, ACR, and specific state standards. During this COVID-19 timeframe, the ability to work from home while keeping the imaging chain running smoothly is critical.

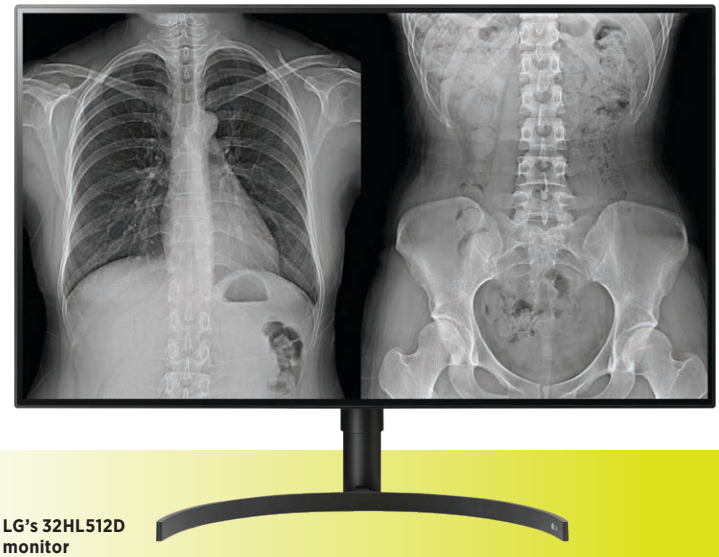
"A lot of hospital systems, reading groups, and individual radiologists have been thrust into having to put a teleradiology solution together quickly," Neill says. "This can be overwhelming.



The latest advances in medical display technology offer better contrast and higher resolution.

Complete systems, including displays, configured [central processing units], and ergonomic workstations, ensure radiologists have everything required to read safely from home, flatten the curve, and still be confident in providing patient diagnosis."

Double Black Imaging has rolled out specific solutions for home reading during the COVID-19 pandemic. "We work to ensure the solution we provide fits the specific site need," Neill says. "Our calibration software is developed here in the USA, written for US standards. This enables quick responses to customer requests and incorporates features to make the radiologist more efficient."



► LG's 32HL512D monitor

Responding to Trends

Double Black Imaging offers diagnostic, mammo/tomo, clinical, and surgical displays to fit areas within the entire enterprise. "All of our diagnostic displays are autocalibrating, and our enterprise management tools include automatic testing, reporting, and alerting," Neill says. "We recognize the importance of ergonomics in the reading room and incorporate our display solutions into ergonomic workstations."

Neill notes that workstation reliability is essential when reading from home without a PACS/IT team to maintain the workstations. "Having automatic calibration, reporting, and e-mail alerting that communicate back to the enterprise or configured to alert them directly gives them that assurance," she says. "In addition, built-in tools reduce eye strain, reduce cursor movement, pinpoint specific areas of interest, increase productivity, and improve workflow."

LG has been developing products with the goal of streamlining processes for medical practitioners and fostering positive patient experiences. With that in mind, LG has released new diagnostic monitors that provide radiologists with improved display resolution and brightness. Impellizeri notes that medical displays with better display technology accurately and consistently enable radiologists to make a diagnosis faster and, in turn, provide faster results to patients.

For example, the new 32HL512D is a 31.5-inch, 8-megapixel (MP) diagnostic monitor with LG Nano in-plane switching (IPS) technology that enhances on-screen colors and grays by absorbing excess light wavelengths, providing higher DICOM accuracy. "The monitor features PBP (Picture By Picture) mode that enables two 4 MP screen operations to work with PACS applications," Impellizeri says. "Additionally, DisplayPort and HDMI video inputs allow easy connection to workstation and laptop computers, making the 32HL512D very popular for home reading." The monitor also features a OneClick stand, lightweight construction, a virtually borderless four-sided design, and a front-embedded sensor to perform hands-free calibration and quality control.

LG's 21HK512D diagnostic monitor is a 21.3-inch, high brightness, 3-MP solution used for viewing images from all medical modalities except mammography. Like the 32HL512D, it is equipped with a front-embedded sensor.

Geert Carrein, vice president of strategic marketing for diagnostic imaging at Barco, says today's displays focus not only on the pixels or brightness but also on how they can improve clinical outcomes and workflow productivity. For example, multimodality displays are in high demand, as they can make things easier for all members of a care team.

"You're also seeing more of a movement to 4K displays," Carrein says. "These are mainly for moving images. In radiology, they tried to introduce it for mammography, but one of the drawbacks was it was developed for the TV industry, and it was not an optimal format for mammography images, where you need the height of the image to display the breast images optimally." There is also a trend to move to higher-resolution images, up to a 12-MP picture that would work better for mammography images.

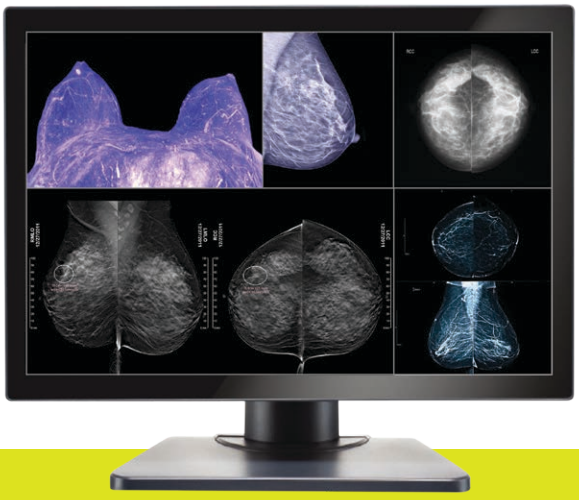
It's no secret that radiologists would prefer to get out of their dark reading rooms into a somewhat brighter venue, but that can bring some drawbacks to displays. For instance, Carrein says the contrast ratio decreases, so new displays that have brighter quality displays are also in demand.

"The radiologist wants more display real estate, [including] using more displays to improve their workflow so they can diagnose faster," Carrein says. "They also want slimmer displays by using technology like [low temperature polysilicon] that allows for integration of smaller transistors on the glass, which then allow displays with smaller vessel sizes."

Bright Ideas

Jeannette Toews, director of displays for Contec Americas Inc, notes that the company is targeting mammography, X-ray, ultrasound, PACS, and other equipment that captures image files in a diagnostic room. "The main display requirements for these applications are clear and crisp images, consistent performance in image quality and uniformity, versatility of connecting to other diagnostic tools or sensors with multiple images displayed on the screen simultaneously, and safety," she says.

IMAGE COURTESY OF LG



► Double Black Imaging's 8 MP Gemini Series monitor

► Contec Americas' 2 MP medical display

In regard to clear and crisp images, Contec is focusing on higher-resolution monitors, with a minimum requirement of 2 MP for general diagnostic applications and at least 5 MP for mammography. "With the LCD technology breakthrough, 8 MP (4K) is becoming the norm for medical displays with the future trend moving into even higher resolution, such as 12 MP and 15 MP in monochrome grayscale displays," Toews says.

Increased brightness makes image quality appear crisper, thus making it easier for human eyes to detect any defects or issues. Higher brightness also enhances the visualization of white, which improves contrast ratio.

"The general brightness requirement for general medical applications is about 250 to 400 nits," Toews says. "For radiology applications, the minimum requirement is 600 nits with color screens and 800 nits for monochrome. With the backlight technology advanced and efficiency improved, it makes higher brightness possible at moderate power consumption with minimal thermal management required." The future trend, therefore, will be to set the maximum screen brightness at 1,000 to 1,200 nits and factory default setting at 600 nits.

In the next year, Contec Americas plans to introduce a 30-inch IPS, 800 nit 6-MP display with a patented self-calibration feature allowing modality manufacturers to calibrate the monitor without connecting to a computer.

"By using the front sensor, the field service engineer can effortlessly run the DICOM calibration simply using the monitor's [on-screen display]," Toews says. "It will also have auto gamma correction, automatically recognizing and applying the correct gamma curve on the images that are displaying." That means no more choosing between DICOM and gamma 2.2 for monochrome or color images. To address safety issues, the display will come with FCC-B, IEC 606061, CB, CCC, and BSMI certifications as well as FDA approval.

US Electronics, Inc, has recently released 24-inch monitors in touch and nontouch versions, available with a high brightness option. Each workstation is powered by an HP computer with an NVIDIA P2000 graphics card. USEI also offers XR-VUE imaging software for clinical review of DICOM images and UCAL-350 calibration software capable of calibrating any monitor to DICOM or other gamma curve settings.

Coming Soon

Technology in the commercial display and TV market is constantly changing and evolving, and many of these advancements will be seen in the medical display market in years to come.

"We anticipate the incorporation of OLED and QLED technology into medical displays, which will raise brightness while enhancing black and white levels without compromising the color values," Neill says. "Displays will also follow their commercial counterparts, providing higher resolutions, thinner and sleeker footprints, and even longer lifespans."

Additionally, Neill expects software tools to further advance productivity, service, and support. She adds that understanding the unique nature of each medical imaging environment will increase in importance, continuing advancements in medical imaging.

Toews sees more advancement in the ability to connect with multiple diagnostic tools or sensors, with multiple images displayed on the screen simultaneously. "This is achieved by equipping the display with communication hubs, such as USB and Serial (RS232) ports," she says. "Medical displays with [picture-and-picture/picture-in-picture] features enable users to view different images on the display simultaneously or zoom into a specific [feature] for more details."

Impellizeri says AI technology is becoming increasingly useful for radiologists to identify possible medical issues that are not yet visible to the human eye, saving time and leading to more accurate diagnoses. That is one of the areas LG will be exploring further in the years to come. "We will continue to release new products with the latest innovative technologies and continue to build our product portfolio for the health care industry," he says. ■

Keith Loria is a freelance writer based in Oakton, Virginia. He is a frequent contributor to ***Radiology Today***.