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MUSICA
Catheter Processing

Enhances neonatal imaging and care

White paper

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White paper

Study shows MUSICA's Fractional Multiscale Processing technology improves catheter visualization for newborns, improving reading quality and reducing potential risks of catheter placement

Executive Summary of "Improved visualization of peripherally inserted central catheters on chest radiographs of neonates using fractional multiscale image processing," published in BMC Medical Imaging

A study evaluating the ability of image processing to improve the visualization of central catheter tip positioning in newborns was recently published in BMC Medical Imaging. The authors found that Agfa's MUSICA Catheter Processing with Fractional Multiscale Processing (FMP) technology significantly improved the perception of low contrast PICC line tips in digital chest X-rays, compared to standard image processing. MUSICA Catheter Processing offers an effective means to improve reading quality in neonatal imaging.

Peripherally inserted central catheters (PICCs) provide secure intravenous access to deliver life-sustaining medications and nutrition. They are commonly used in pediatrics, with a small luminal diameter being required for small newborns.

Possible complications can arise, however, when using PICCs in neonates and children: including infection, accidental dislodgement, occlusion, local infiltration, breakage and thrombosis. In particular, a non-central tip location results in an increased rate of complications. Therefore, fast and secure verification of central catheter tip position during the placement procedure or immediately after insertion is crucial.

Verification is usually done by an X-ray. But the visualization of small catheter tips on digital chest X-rays can be difficult, as exposure parameters (and image processing) are primarily set to produce the 'best average image' to demonstrate a wide range of pulmonary, mediastinal and other abnormalities. Consequently, the fine, translucent catheters can easily be masked.

The aim of the study was thus to investigate the value of Fractional Multiscale image Processing (FMP) for creating a dedicated PICC image.

MUSICA post-processing software with FMP

Agfa's standard image processing software and the dedicated Catheter Processing software are both based on Agfa's MUSICA image processing technology. Conventional (standard) image processing computes the multiscale decomposition using a series of spatial filters. Typically, these filters calculate a weighted average of pixels in a local neighborhood surrounding each pixel in the image, called the filter kernel.

Agfa's patented Fractional Multiscale Processing (FMP), decomposes the filtered kernels into smaller fractions at each scale. The individual kernel fractions, rather than the weighted sum, are enhanced resulting in significantly better detail. A dedicated MUSICA version, based on FMP technology, was developed with specific adjustments to enhance catheters and PICC lines in X-rays.

When the MUSICA Catheter Processing is used, a second companion image is created that focuses attention on tiny tubular structures, aiding the radiologist and clinicians to identify and visually follow the catheter outline down to the tip.

Study objective

The aim of the study was to evaluate the ability of Fractional Multiscale Processing (FMP) to detect PICC tips on digital chest X-rays of newborns.

Method

A total of 94 X-rays of 47 patients were included in the study. 29 patients were male, 18 were female. The mean age of all examined children was 9.2 days (range 0–99 days). In total, six readers (two radiologists, two radiology residents, one final-year medical student and one neonatologist) evaluated 94 unprocessed and catheter-enhanced X-rays using a 5-point Likert scale (1 = poor catheter tip visualization, 5 = excellent catheter tip visualization). X-rays were evaluated on a dedicated workstation.

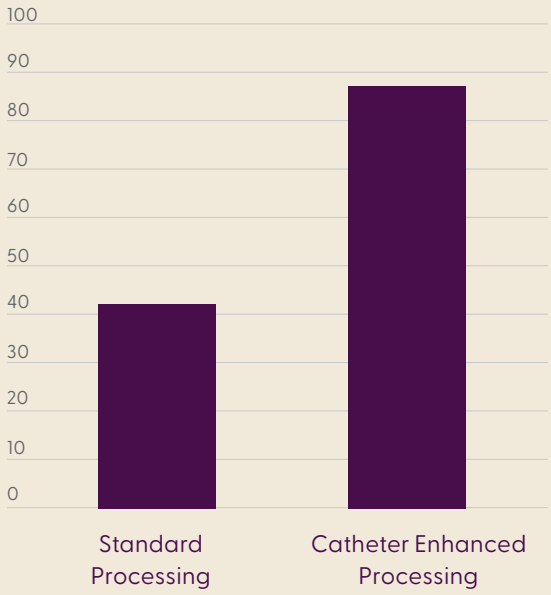
Results

In all cases, the X-ray with catheter enhancement rated higher than (n = 471), or equal to (n = 93) the X-ray made with standard processing, for visualizing catheter tips. As shown below, 87% of the catheter- enhanced X-rays were rated 4 or higher, while only 42% of the X-rays with standard processing received 4 or more points.

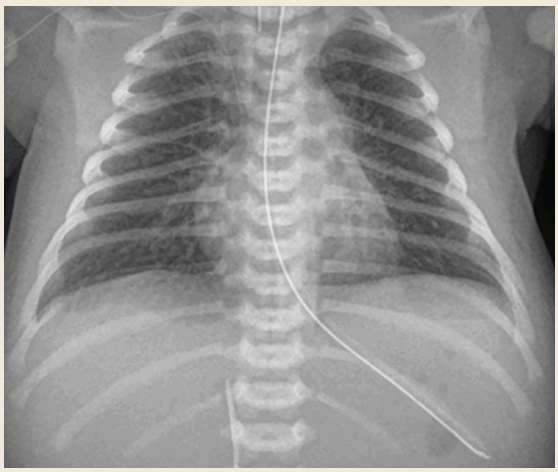
Conclusion

Catheter-enhanced digital chest X-rays using FMP technology offer improved visualization of low contrast PICC tips in newborns compared to X-rays using standard processing.

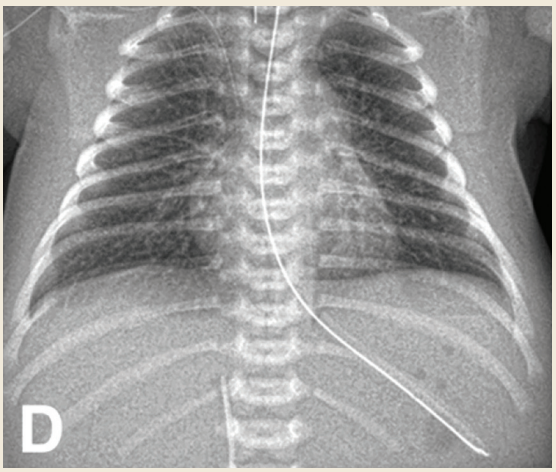
Radiographs scored with 4 or higher in %
Score of 4 or higher = good or excellent catheter tip visualization



Standard Processing versus Catheter Enhanced Processing



Standard Processing



Catheter Enhanced Processing

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