



The aim of this study is to evaluate the ability of Fractional Multiscale image Processing (FMP) to detect PICC tips on the digital chest radiographs of neonates” Hammon et al (2019).

Abstract:

BACKGROUND: Peripherally inserted central catheters (PICCs) provide secure intravenous access for the delivery of life-sustaining medications and nutrition. They are commonly used in pediatrics. Confirmation of correct central catheter tip position is crucial. Verification is usually done by a radiograph. The aim of this study is to evaluate the ability of Fractional Multiscale image Processing (FMP) to detect PICC tips on the digital chest radiographs of neonates.

METHODS: A total of 94 radiographs 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 residents in radiology, one last year medical student, one neonatologist) evaluated 94 unprocessed and catheter-enhanced radiographs using a 5-point Likert scale (1 = poor catheter tip visualization, 5 = excellent catheter tip visualization). Additionally, the two radiologists evaluated the diagnostic confidence for chest pathologies using a 5-point Likert scale (1 = poor diagnostic confidence, 5 = excellent diagnostic confidence). Radiographs were evaluated on a dedicated workstation.

RESULTS: In all cases, the catheter-enhanced radiograph rated higher than ($n = 471$), or equal ($n = 93$) to, the unprocessed radiograph when visualizing catheter tips. 87% of the catheter-enhanced radiographs obtained a rating of 4 or higher, while only 42% of unprocessed radiographs received 4 or more points. Regarding diagnostic confidence for chest pathologies one radiologist rated two catheter-enhanced radiographs higher than the unprocessed radiographs, while all other 186 evaluations rated the catheter-enhanced radiographs equal to ($n = 78$) or lower than ($n = 108$) the unprocessed radiographs. Only 60% of the catheter-enhanced radiographs yielded a diagnostic confidence of 4 or higher, while 90% of the unprocessed images received 4 or more points.

CONCLUSION: Catheter-enhanced digital chest radiographs demonstrate improved visualization of low contrast PICC tips in neonates compared to unprocessed radiographs. Furthermore, they enable detection of accompanying chest pathologies. However, definitive diagnosis of chest pathologies should be made on unprocessed radiographs.

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Reference:

Hammon, R.A., Seuss, H., Hammon, M., Grillhösl, C., Heiss, R., Zeilinger, M., Bayerl, N., Vuylsteke, P., Wanninger, F., Schroth, M., Uder, M. and Rompel, O. (2019) Improved visualization of peripherally inserted central catheters on chest radiographs of neonates using fractional multiscale image processing. *BMC Medical Imaging*. 19(1), p.3.

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