Addressing the X-tras in X-rays

Evaluating the impact of a nurse-led quality improvement project.

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Introduction & Aims

The first stage of a nurse-lead quality improvement project identified that chest x-ray artefact and suboptimal patient positioning may result in poor image quality and the need for repeat imaging within the Children's Intensive Care Unit. Studies have shown that children and neonates are more sensitive to ionizing radiation as compared to adults[1]. Poor quality radiological imaging can necessitate repeat examinations[1], exposing patients to additional radiation doses. The average dose per capture can vary between 0.05 – 0.24 mSv[2]. As children have an increased risk of biological effects and lifetime cancer[3], reduction in unnecessary radiation exposure is essential within this patient cohort. Common artefact included monitoring equipment (ECG, ETCO2) ventilation tubing and infusion giving sets. This stage of the project focused on the development, implementation and evaluation of an aide-memoire to reduce the number of artefacts on chest x-rays, optimise patient positioning and improve the quality of the image.

Methods

Utilising data from the first stage of the project, a bed-side aide memoir/checklist was created for use by the bedside nurse and radiographer, to optimise patient positioning and reduce the number of artefacts on chest x-rays,. to address the common factors that may affect the quality of the chest x-ray image (Figure 1). To aide memoir was implemented in practice from January 2022. A retrospective review of all chest X-rays performed on each patient, during their PICU admission was carried out between January May 2022. Included within the review were mobile, supine chest x-rays, taken within the department. Images transferred to the Picture Archiving and Communication System (PACS) from the referral hospital were excluded. Data was collated utilising the existing excel spreadsheet from the initial stage of the project, to allow comparison of pre and post implementation data.

Figure 1

Bedside Check list to improve the quality of chest x-rays

- ❑ Position ECG stickers on shoulders and bottom rib, mid axillary line.
- ❑ Remove all infusion lines and ETT tubing from the field of view.
- ❑ Remove all unnecessary items from underneath the patient (blankets, lines etc).
- ❑ Ensure patient comfort by covering the x-ray plate with a pillow case.
- ❑ Position the child supine and midline.
- ❑ Ensure the chin is out of the field of the X-ray beam where safe to do so.
- ❑ Position the head in a neutral position for < 1 year of age.
- ❑ Position the head in a "sniffing the morning air" position for > 1 year of age.
- ❑ Move the arms slightly away from the body, out of the field of view.
- ❑ Once position optimised, document NGT & ETT position before x-ray performed.

Results

During the post-implementation phase, 139 images were reviewed. Of these, 17.9% contained artefact that obscured the field of view. In comparison, pre-implementation data demonstrated the presence of artefact within 44.8% of images (Figure 2). The predominance of artefact was identified as either ECG monitoring and ventilation tubing. Artefact classified as "other" included a nasogastric tube drainage bag and a caregivers hand in the post implementation data. Although there had been "other" artefact within the pre-implementation data ($ETCO_2$ monitoring, in-line suction) this had been grouped with ventilation tubing artefact.

Patient positioning was previously identified as a common factor contributing to suboptimal image capture. Following the introduction of the aid memoir, the data demonstrated a slight improvement in rotation and neck flexion within all images, however the incidence of head rotation remained unchanged (Table 1).

Figure 2

Comparison of artefact data

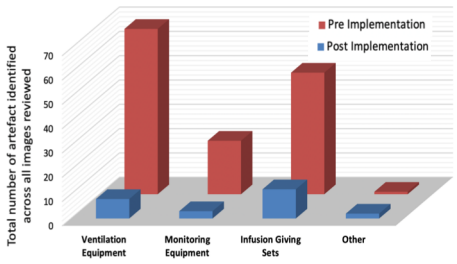


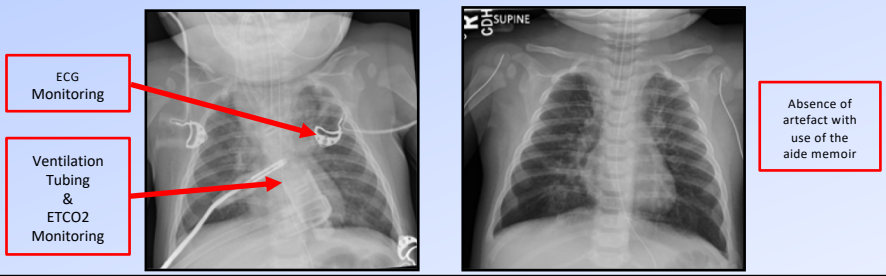
Table 1

Comparison of position quality data

Positioning Quality	Pre-implementation	Post-implementation
Chest Rotation	26% of all images reviewed	12% all images reviewed
Head Rotation	20% of all images reviewed	20% of all images reviewed
Neck Flexion	25% of all images reviewed	21% of all images reviewed

Figure 4

Comparison of image quality pre and post implementation of the bedside aide memoir



Conclusion

Through the introduction of a simple bed-side aide memoir, this quality improvement project has demonstrated an overall reduction in artefact from chest x-rays performed within the Children's Intensive Care Unit (Figure 4). The findings of this QIP will be shared with our radiology department, to ensure all practitioners utilise the aide memoir to optimise image quality and reduction in the need for further imaging. The next stage of the project will focus on re-audit of practice, to include a comparison of documented ET tube and NG tube within clinical notes and imaging records.

References

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