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Addressing Frequent Leaks in CADD Y Extension Tubings: Improving Analgesia Delivery and Patient Safety

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Introduction & Background

Computerized Ambulatory Delivery Device (CADD) pumps are used for Patient Controlled Analgesia (PCA) & Nurse controlled analgesia (NCA) (Fig.1) to optimize pain management for pediatric patients with severe pain. Opioids are locked in these pumps for safe and timely delivery of pain relief via their compatible Y extension tubing.



Fig. 1. Picture of CADD pump on patient

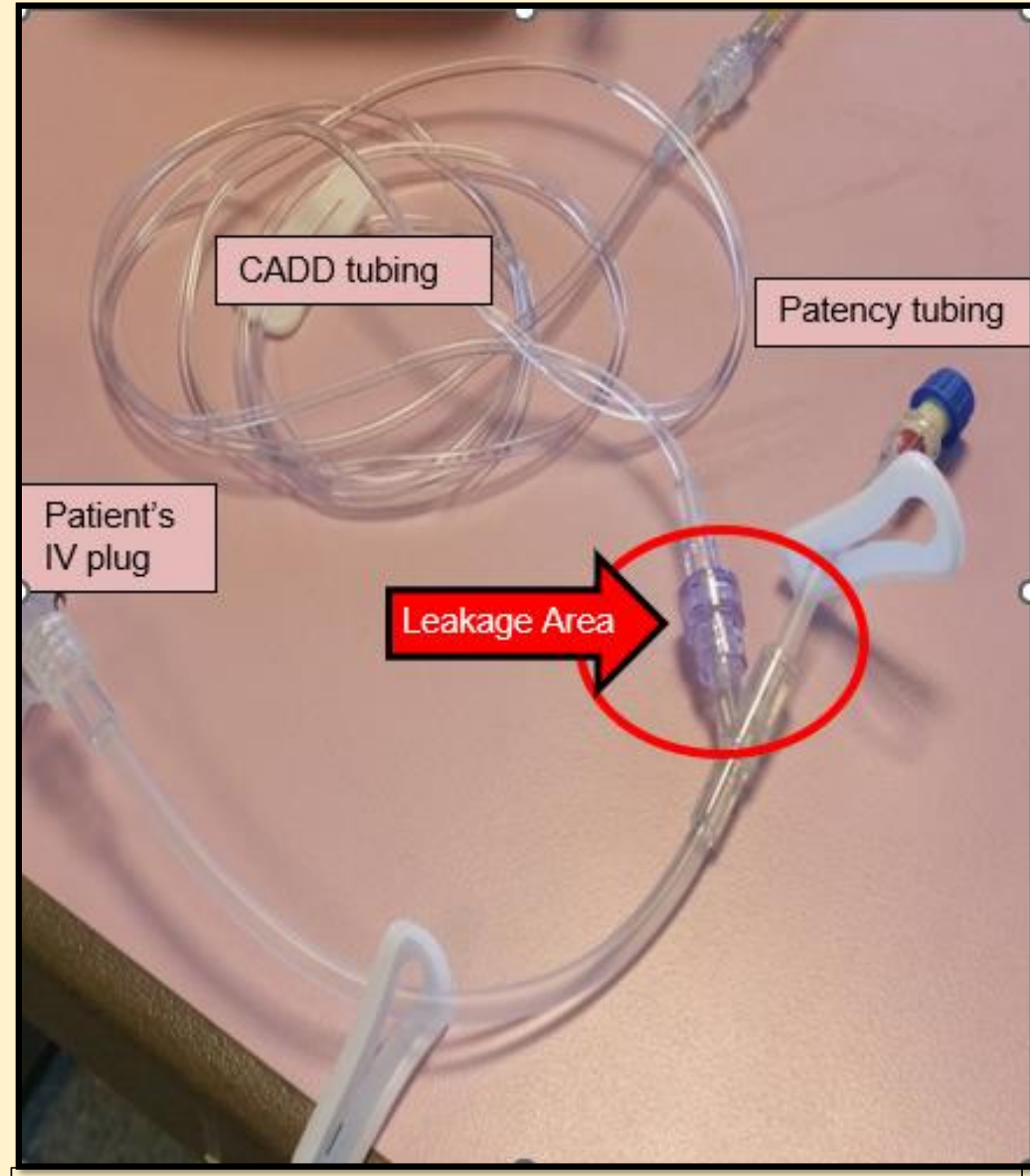


Fig. 2. Picture of CADD Y tubing showing leakage area

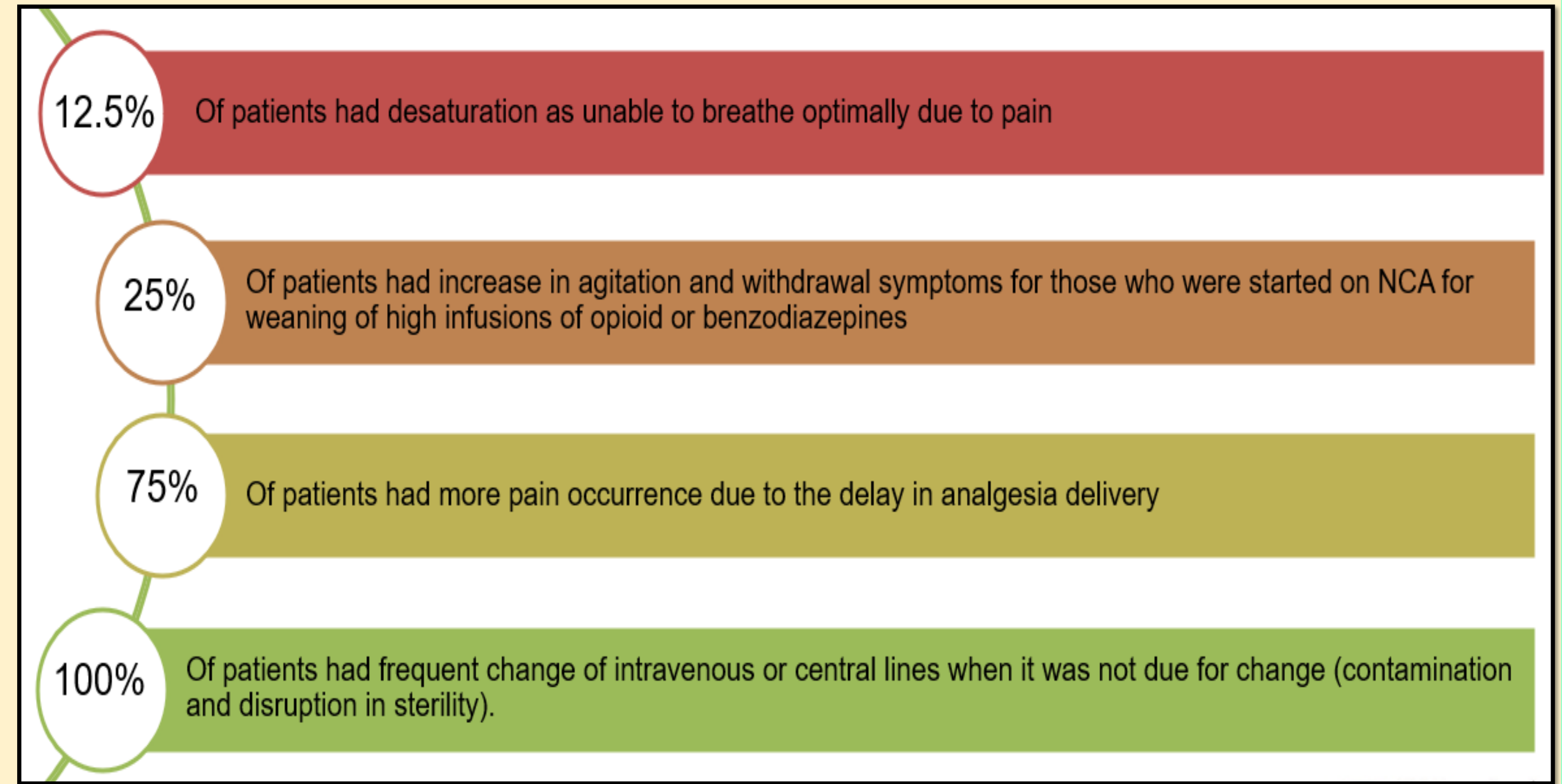


Fig. 3. Number of consequences of CADD tubing leakage

Recent encounters revealed incidences of frequent leaks from the Y extension tubing (Fig.2).The leaks resulted in patient discomfort and potential complications (Fig 3). Inadequate pain management can lead to desaturation due to shallow breathing and increase in agitation and withdrawal symptoms especially for patients started on NCA for weaning of high infusions of opioids. Undetected leaks may also necessitate premature replacement of intravenous or central lines, disrupting sterility protocols and increasing costs.

Problem Statement & Motivation

To address the root causes of frequent leaks in Y extension tubing and to prevent adverse clinical outcomes and optimize analgesia delivery for patient safety. Our team aimed to eliminate CADD tubing related leaks from intravenous central lines in 6 months

Method

Root Cause Analysis (RCA) identified some possible reasons for the leaks. A total of 3 Plan-Do-Study-Act (PDSA) was carried out to rectify the issues (Fig.4).

PDSA 1: Nurses had mistakenly force opened the fused area of the tubing. Reinforcements and emails were sent on awareness of CADD Y extension tubing connection.

PDSA 2: Another reason for the leak was due to faulty tubing and the vendor replaced the batch of stock.

PDSA 3: It was found that most of the leaks happened in Children's Intensive Care Unit and Oncology areas where multiple infusions are connected to one intravenous or central line leading to overload of fluid or pressure. The Y extension tubing was unsuitable to support PCA/NCA modalities. Team collaborated with vendor for other feasible alternatives.

Solution

Introduction of new straight-line CADD tubing for pediatrics

Results

A total of 8 reports of incidences of frequent leaks from Y extension tubing in 2021 and 2022. Some reasons for leak include nurses who mistakenly force opened the fused area of the tubing, and another was due to faulty tubing. Out of 201 case of patients on CADD, only one leakage incident happened during the six-month trial period. Subsequently, no further leakages were reported, prompting implementation of the use of straight line tubings in all CADD pumps in all pediatric patients

There was no leakage for past 1 year after implementing the new strategy. No pain complains were reported from patients due to tubing leaks. This abolished the necessity of breaking the IV-line system. Time taken to change the line by nurses and anaesthetists was shortened resulting in cost savings to patients.

A pictorial guide (Fig.6) on standard PCA/NCA opioid connections for nurses and anesthetists was disseminated to all wards, operating theatre and recovery area where CADD pumps are being initiated.

Conclusion

Even a small gap can lead to a big consequence. Every incident identified should be considered as there may be a solution after much brainstorming and investigation.

Pediatric setting can vary largely compared to adults. What works in other areas and in adults may not work for pediatrics even though it is the same drug, tubing and pump. The trial's success underscores the need for tailored solutions in paediatric settings, where standard approaches may not suffice despite utilizing identical equipment and medication.

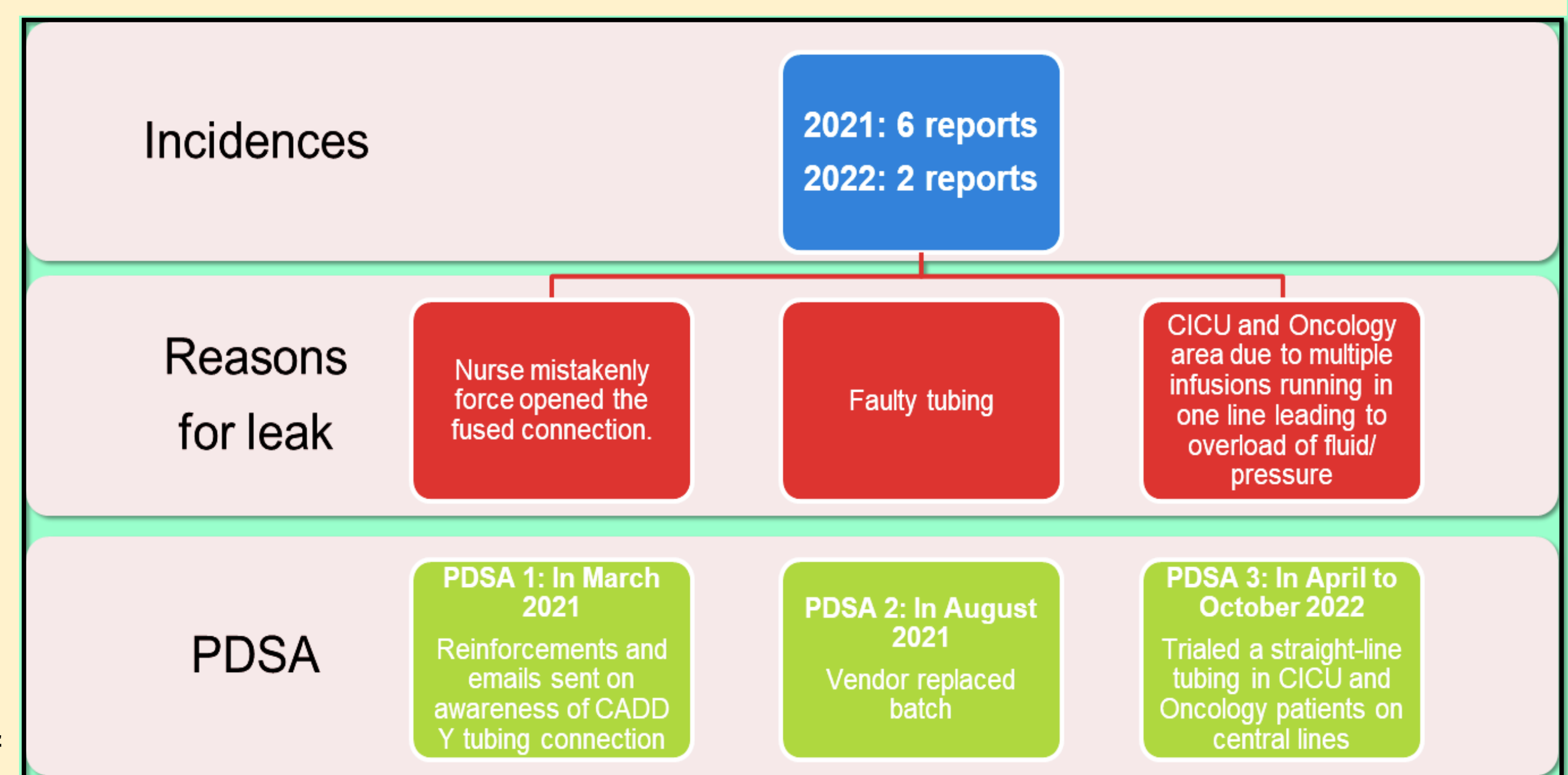


Fig. 4. RCA of the reports over 2 years, 3 PDSA cycles

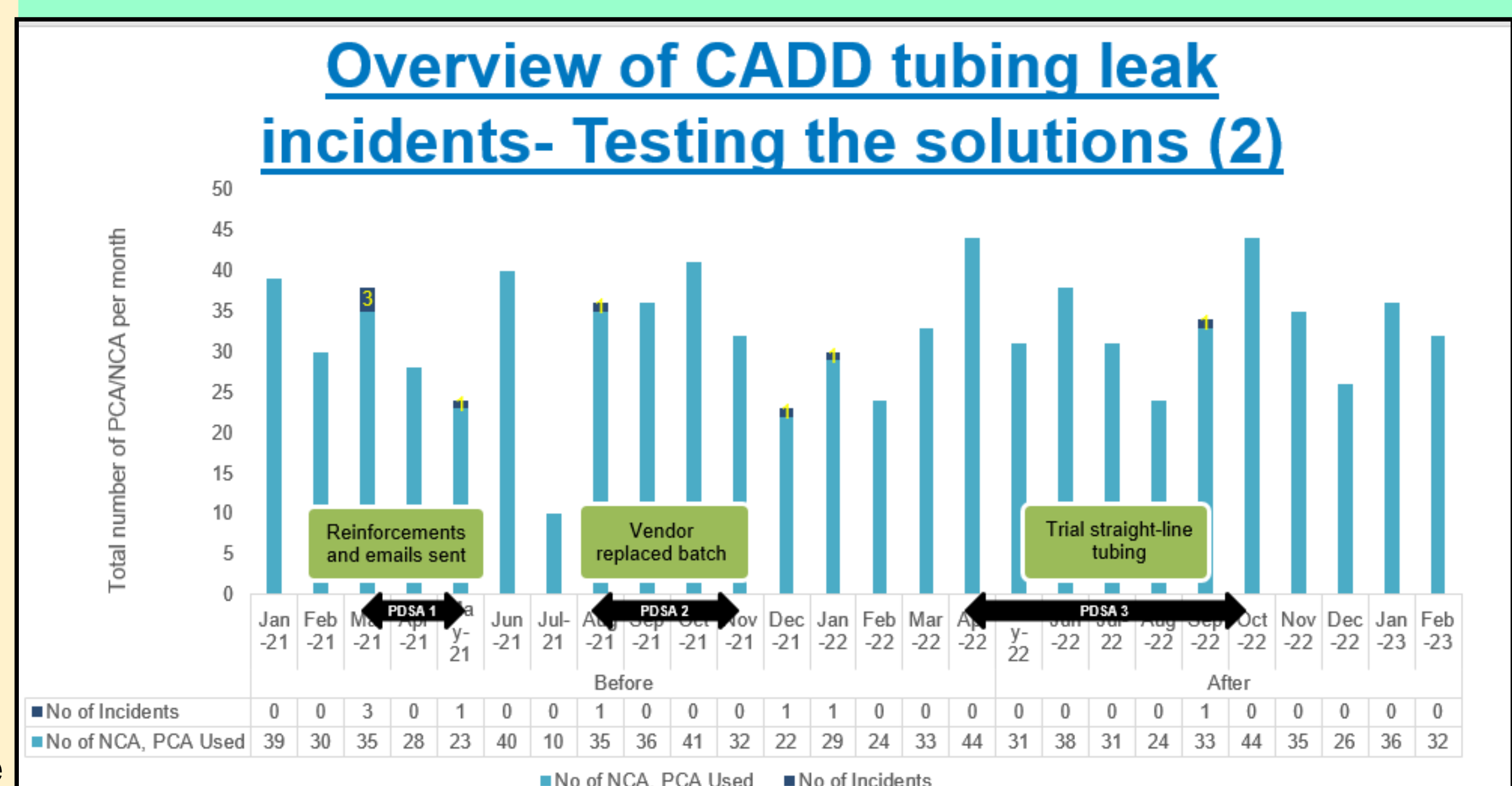


Fig. 5. Overview of CADD tubing leak incidents and the solutions

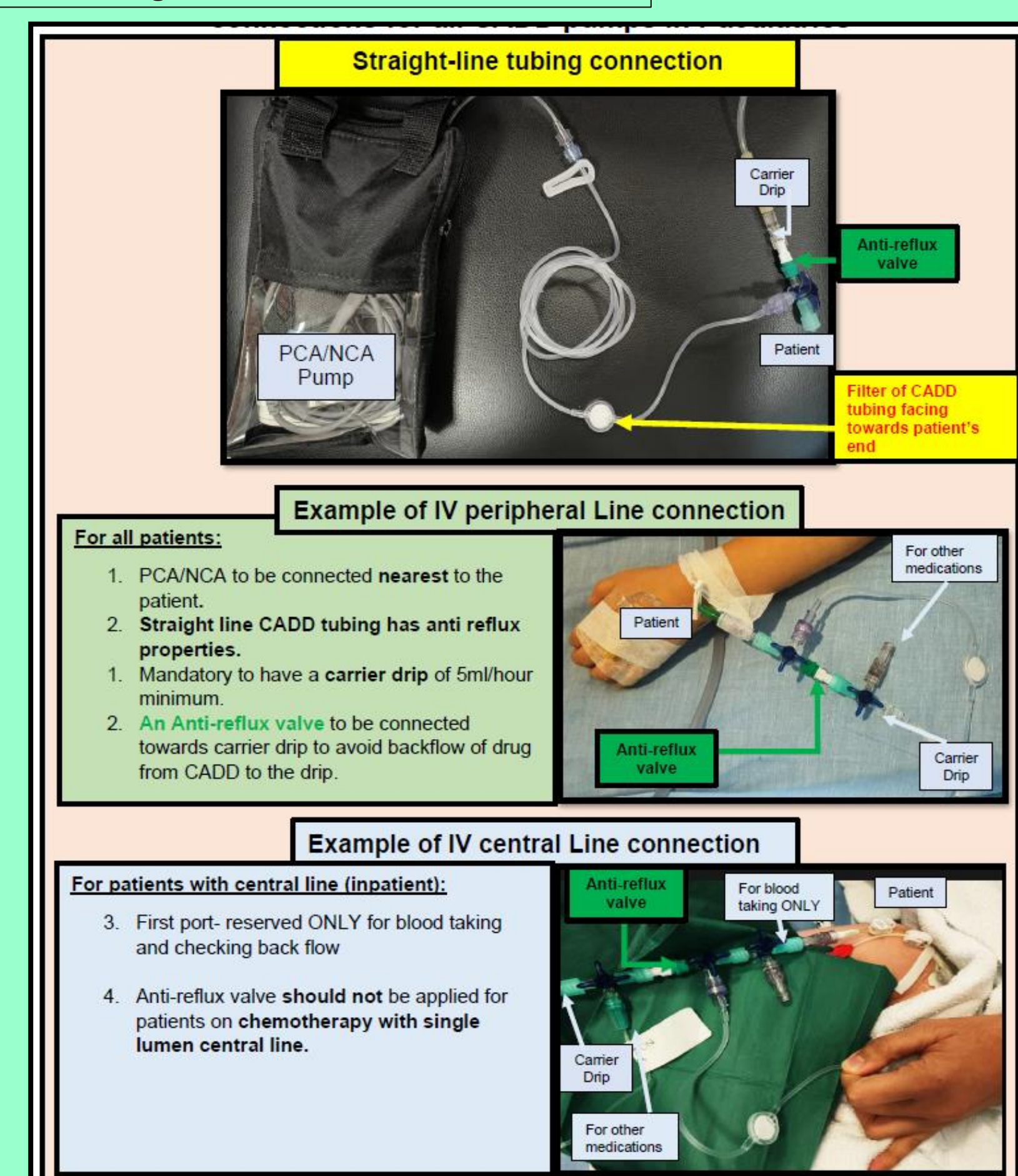


Fig. 6. Pictorial guide on standard PCA/NCA connections for all pediatric patients