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Defining the Problem and Goal

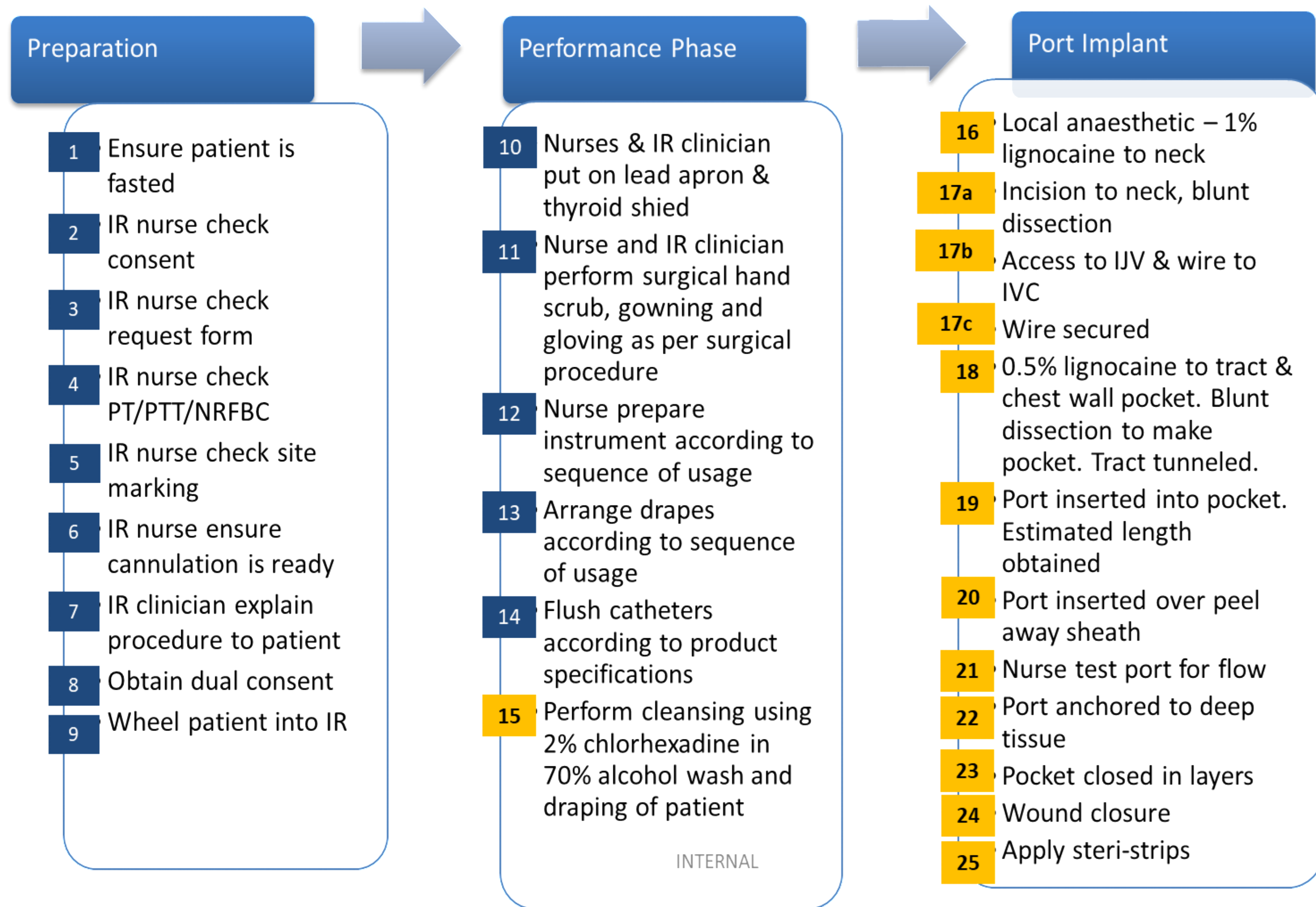
- Cancer patients who have poor venous access, or who are receiving infusional chemotherapy, require central venous line insertion to facilitate treatment. Port-A-Caths (PAC) are one of the most common forms of central venous access chosen by medical oncologists for use in cancer patients.
- PAC insertion is generally a safe procedure, but complications can arise. Complication rates post-PAC insertion reported in published literature vary from 0.1% to 7.6%, and may be subject to reporting bias.
- An audit of 56 PACs inserted at NUH between October 2018 and December 2018 revealed that the average monthly complication rate was ~15.6%, with majority of the complications occurring within 30 days of insertion.
- A team from Diagnostic Imaging, Haematology-Oncology, Nursing and Infection Control was formed to analyze potential causes of complications and improve the workflow.
- We aim to reduce the PAC early complication rate within 30 days from insertion) for Haematology-Oncology patients from an average of 15.6% to <2%.

Methodology

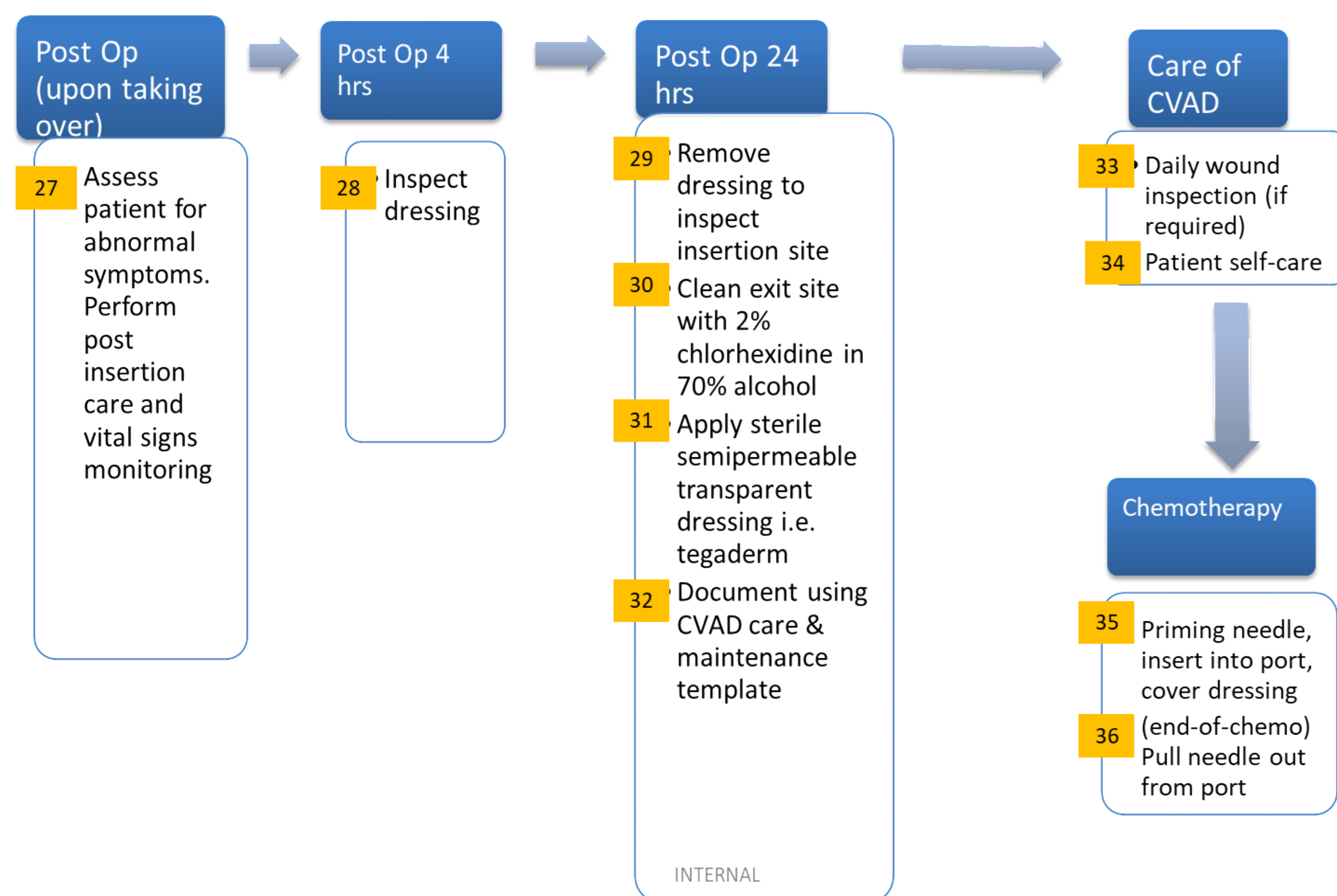
- Process mapping of the entire patient journey from the PAC preparatory phase, to insertion, post-procedural care and commencement of chemotherapy was performed.
- Using Healthcare Failure Mode and Effect Analysis methodology, the team examined potential weak links in the process map.

Problem Analysis

Process Mapping: Preparation and PAC Insertion



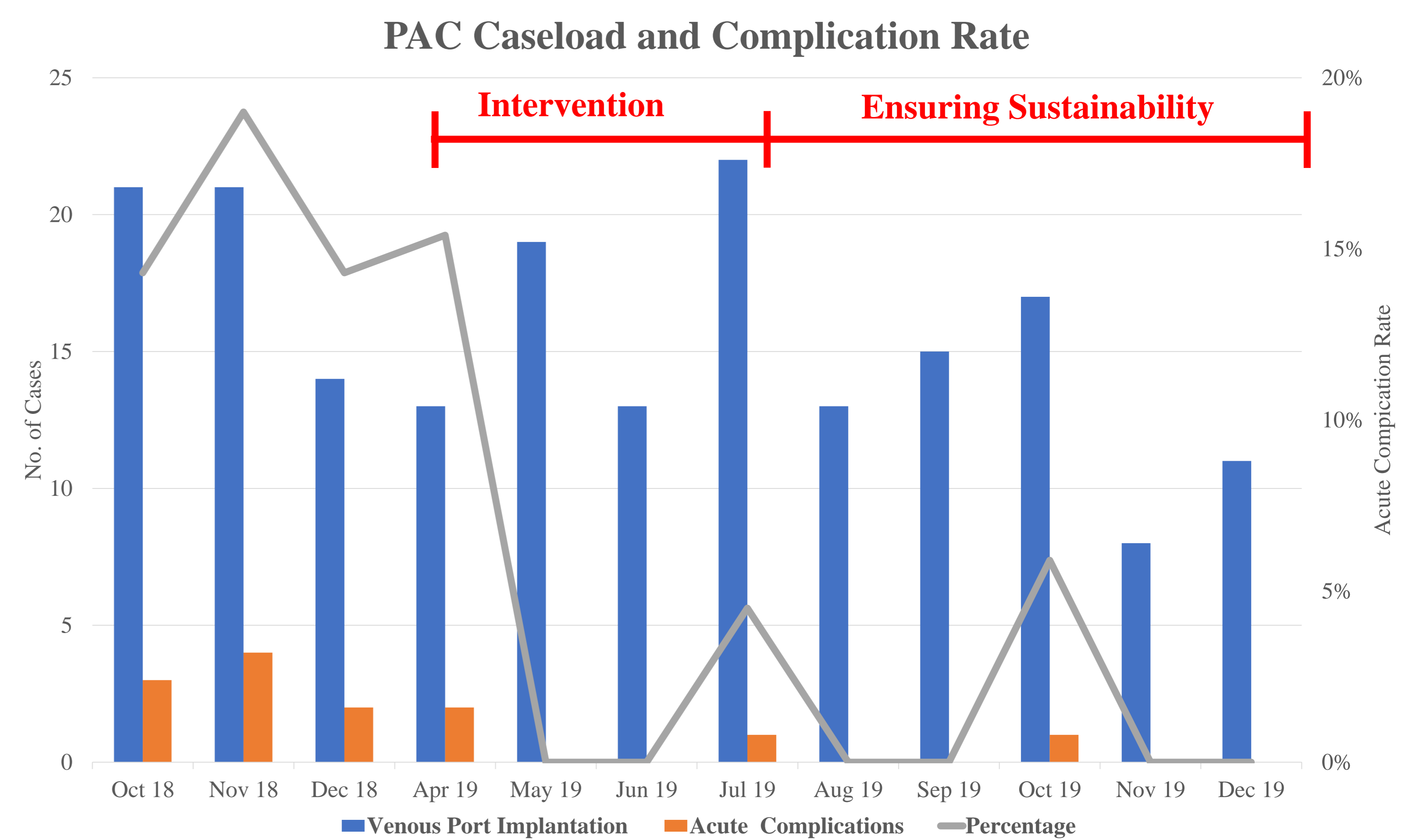
Process Mapping: Post-Procedural Care



Strategy for Change

| Problem | Intervention | Date of Implementation |
|---|---|------------------------|
| Non-Standardised PAC Insertion Techniques | Standard techniques and practices for existing and new doctors in Diagnostic Imaging was established <ul style="list-style-type: none"> • Implanting PAC at a uniform depth (0.5-2cm) • Closing wound in layers • Compulsory subcuticular sutures and introduction of Dermabond | April 2019 |
| Potential Early Wound Disruption | <ul style="list-style-type: none"> • Extending PAC wound inspection to 48h to prevent unnecessary wound dehiscence • Commencement of same-day chemotherapy was not permitted • Chemotherapy nurses were empowered to recommend not to commence chemotherapy to primary oncologist, based on wound assessment | April 2019 |
| Late Identification of PAC Complication | <ul style="list-style-type: none"> • Strengthen patient education pre-PAC insertion with mandatory counselling sessions, and revamping patient education material • Establish workflow to escalate to senior nurse, medical oncologist and Diagnostic Imaging upon recognition of PAC complication | April 2019 |

Measurement of Improvement



Introduction of interventions resulted in dramatic reduction in Acute PAC Complications from an average monthly rate of 15.6% (October 2018 – December 2018) to 1.3% (May 2019 – December 2019). Prevention of acute complications would result in average saving of \$1715 per episode, and allow for timely cancer treatment.

Measures for Sustainability

- Interventions were communicated to key stakeholders at respective department meetings
- Culture of early recognition and early escalation for acute PAC complications was formed
- PAC complications are tracked systematically and communicated to ensure timely and continuous feedback loop between Diagnostic Radiology, Haematology Oncology and Nursing

Conclusion

- Meticulous examination of the entire process map showed key weaknesses and gaps resulting in acute PAC complications
- Using Healthcare Failure Mode and Effect Analysis, our multidisciplinary team was able to introduce a suite of targeted interventions, resulting in rapid reduction in the acute PAC complication rate
- Prevention of PAC complications translated to direct cost savings for the patient
- By continuously engaging stakeholders and regular data monitoring, we were able to sustain the results and will continue to strive for better outcomes