

Project Title

Prevention of Kinkage of Distal Perfusion Catheter for ECMO Circuit

Project Lead and Members

Project members: Charmaine Ong, Low Hui Ling, Lye Choy Mei, Haziqah Binte Idris,
Lim Yok Yen, Ng Jing Wei, Hong Rilong & Jasmine Lee

Organisation(s) Involved

National Heart Centre Singapore

Healthcare Family Group(s) Involved in this Project

Nursing

Applicable Specialty or Discipline

Nursing

Project Period

Start date: July 2022

Completed date: August 2023

Aims

Detrimental impact of vascular complications such as LL amputation and fasciotomy affects survival. Besides significant decline in quality of life, it increases medical cost and prolonged hospital stay. Therefore, it is utmost importance to keep DPC patent.

Project Attachment

See poster appended/ below

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Lesson Learnt

If given an opportunity to start all over, the team will engage A.L.I.C.E @ SGH Campus at the beginning of the project at PDCA #1.

Additional Information

National Healthcare Innovation & Productivity (NHIP) 2024 – Best Practice (Care Redesign category)

Conclusion

See poster appended/ below

Project Category

Care & Process Redesign

Value Based Care, Functional Outcome

Keywords

Distal Perfusion Catheter, ECMO Circuit

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Prevention of kinkage of Distal Perfusion Catheter for ECMO Circuit

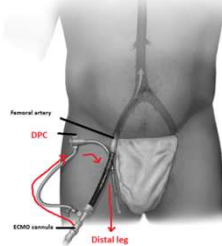
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Problem Statement

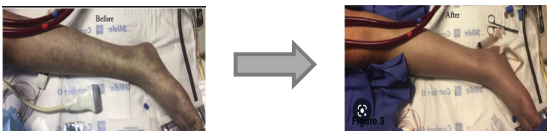
ECMO is a life saving machine that takes over the function of the heart and lungs. The cannulas are inserted over both groins and is now a mainstream lifesaving treatment modality in critical care medicine. To prevent Lower Limb (LL) ischemia, Distal Perfusion Catheters (DPCs) are inserted. DPC diverts blood and improves arterial circulation of the LL. On the other hand, fixation of DPC to ECMO circuit creates acute angles, making it prone to kinks. Such external mechanical occlusion is prevalent during patient's movement and repositioning.

Without reinforcement, DPC bends easily, halting the flow of blood to the limbs. As such, it increases the risk of developing LL ischemia and acute compartment syndrome. Furthermore, any kinks weakens DPC, making it more likely to kink again at the same site.



Project Aim

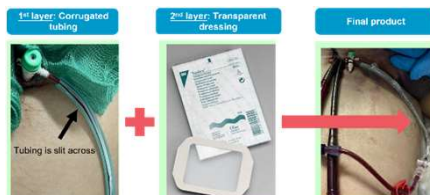
Detrimental impact of vascular complications such as LL amputation and fasciotomy affects survival. Besides significant decline in quality of life, it increases medical cost and prolonged hospital stay. Therefore, it is utmost importance to keep DPC patent.



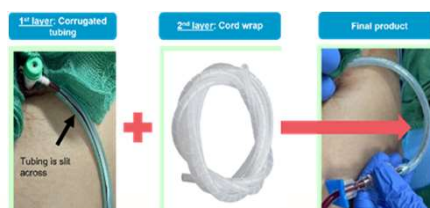
Lessons Learnt

Ward resources were utilized to increase DPC's radius strength. In the 1st PDCA, the adhesive dressing traps blood and stools, harboring pathogens in between dressing folds. The dressing was subsequently replaced with cord wrap in 2nd PDCA. However, it occludes the direct visibility of DPC, blood separation might not be noticeable and could led to thrombotic event.

PDCA 1



PDCA 2



Potential Solutions

In the final PDCA, a new prototype 'DPC organizer' was created with medical grade material. The flexibility of the DPC organizer allows DPC to bend without compromising blood flow to the distal limb. The single use of DPC organizer meets the infection prevention control standard.

- Feature 1:** DPC organizer is made of 20 pegs. The flexible material permits it to bend according to the curvature of DPC
- Feature 2:** Each peg consists of a 'mushroom head' and the groove locks DPC securely within the grid.



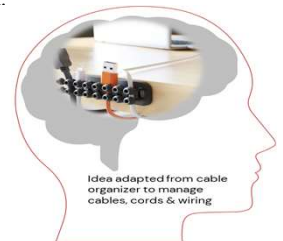
Top view



Side view



Fitted with DPC



Idea adapted from cable organizer to manage cables, cords & wiring

Validation of Final Solutions

Rapid Prototyping	1st Generation Prototype (Jul 22 - Aug 22)	2nd Generation Prototype (Sep 22 - Mar 23)	3rd Generation (Final) Prototype (Apr 23 - Aug 23)
Corrugated tubing with transparent dressing/cord wrap vs DPC organizer	Corrugated tubing with transparent dressing	Corrugated tubing with cord wrap	DPC organizer
Time taken to reinforce DPC	120 seconds	300 seconds	5 seconds
Time taken to remove	200 seconds	180 seconds	5 seconds
Risk of dislodging neighboring invasive lines	Low to medium	High	No
Risk of sharp injury	High	High	No
Require physical inspection for kinked DPC	No	No	No
Prevent kinked DPC	Yes	Yes	Yes

Outcomes & Impact

The secure fitting of DPC within the organizer prevents bends and kinks. It can be easily applied and removed. Thus, reducing the risk of cutting and dislodging the DPC or other invasive lines during dressing change.



Conclusion

DPC organizer secures DPC within its grid and prevents any bending or kinking. It is disposable and it eliminated chances of harbouring pathogens when soiled. The innovation save limb, save cost and improve safety for patients. It can be used for other medical drainage devices with dedicate lumen such as cope loop drainage or pigtail drainage.