

Project Title

Improving Prone Positioning Process for Acute Respiratory Distress Syndrome (ARDS)

Project Lead and Members

- Dr Tan Hui Li
- Xu Xu Hong
- Chiu Hung Ling
- Patricia Yong
- Dr Tan Qiao Li
- Dr Sewa DuuWen
- Dr Ng Shin Yi
- Dr Phua Ghee Chee

Organisation(s) Involved

Singapore General Hospital

Aims

The aim of this project is to reduce the time taken to implement Prone Positioning by 50 and to reduce the incidence of pressure injuries by 90 within 12 months.

Background

See poster appended / below

Methods

See poster appended / below

Results

See poster appended / below



Conclusion

See poster appended / below

Additional Information

Singapore Healthcare Management (SHM) Conference 2021 - Merit Award (Operations Category)

Project Category

Care & Process Redesign

Keywords

Care & Process Redesign, Healthcare Training & Education, Safe Care, Intensive Care, Root Cause Analysis, Plan Do Check Act, Cost Effectiveness, Simulated Training, Healthcare Administration, Nursing, Singapore General Hospital, Acute Respiratory Distress Syndrome, Lung Recruitment, Prone Position, Pressure Injuries, Specialty Nursing

Name and Email of Project Contact Person(s)

Name: Dr Tan Hui Li

Email: singaporehealthcaremanagement@singhealth.com.sg

Improving Prone Positioning Process for Acute Respiratory Distress Syndrome (ARDS)

Singapore Healthcare Management 2021

Dr Tan Hui Li₁, Singapore General Hospital Xu Xu Hong₁, Singapore General Hospital Chiu Hung Ling₁, Singapore General Hospital Patricia Yong₁, Singapore General Hospital Dr Tan Qiao Li₂, Singapore General Hospital Dr Sewa DuuWen₂, Singapore General Hospital Dr Ng Shin Yi₃, Singapore General Hospital Dr Phua Ghee Chee₂, Singapore General Hospital

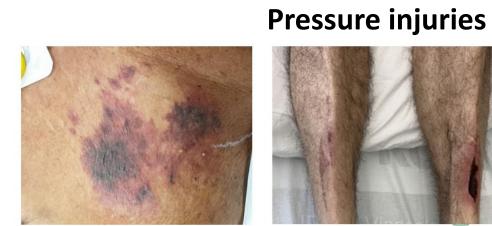
¹ Nursing Division / Speciality Nursing, ²Dept of Respiratory Critical Care Medicine, ³Dept Surgical Intensive Care

Introduction

Widespread inflammation in the lungs may result in a life-threatening condition called acute respiratory distress syndrome (ARDS). Large randomized studies and meta-analysis have shown that prone positioning (PP) improved oxygenation and survival rates in mechanically ventilated patients with ARDS. Despite the evidences, the use of prone positioning in the intensive care units (ICUs) has often been limited or delayed by the physical challenges and associated risks such as inadvertent endotracheal extubation, hemodynamic instability, pressure injuries, and arterial and catheter dislodgements.

PDCA 2 : Trial of commercial prone devices, multidisciplinary procedure and crisis simulation training









artial pressure to fractional inspired oxyg



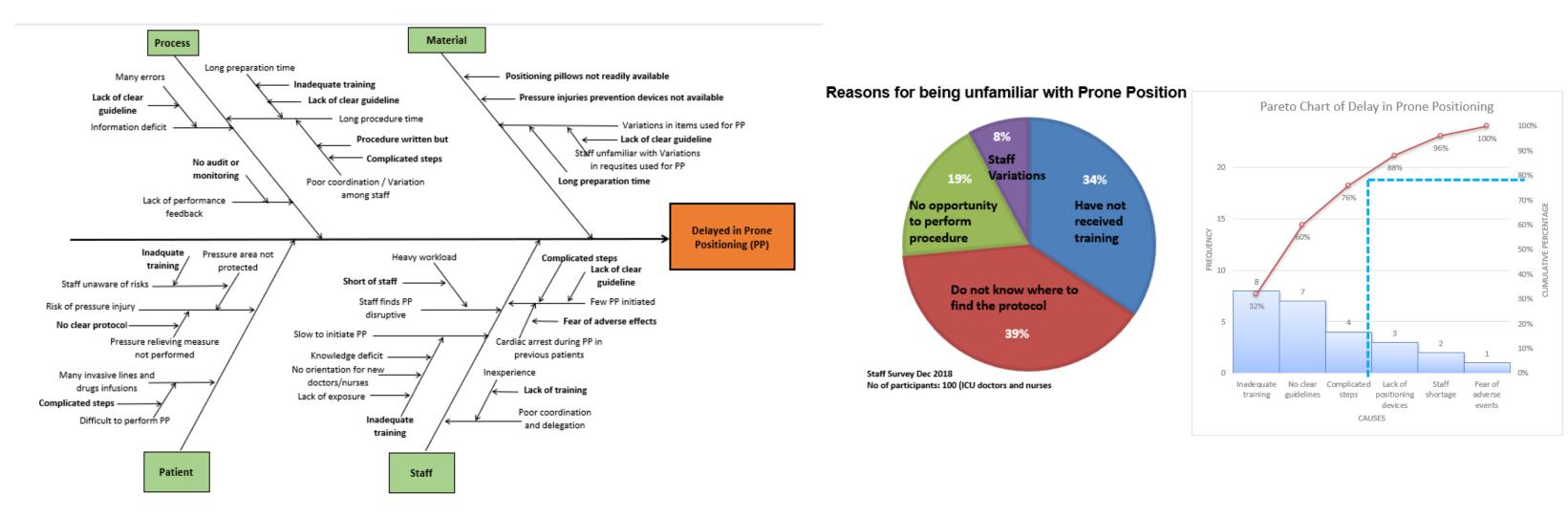
Aim

To reduce the time taken to implement PP by 50% within 12 months To reduce the incidence of pressure injuries by 90% within 12 months

Methodology

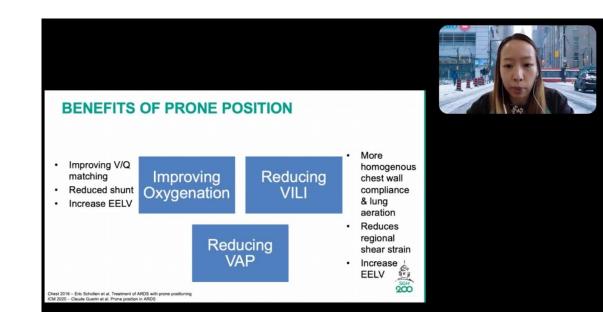
A multi-disciplinary workgroup was formed. Support was obtained from senior administrators. The project was registered under SGH QIP and scoped to cover all ICUs.

Root cause analysis: Utilising cause-effect analysis, observing PP process, and obtaining feedback and survey from ICUs staff, potential root causes of delay in initiation, safety gaps, procedure time, complications and pressure injuries were identified.

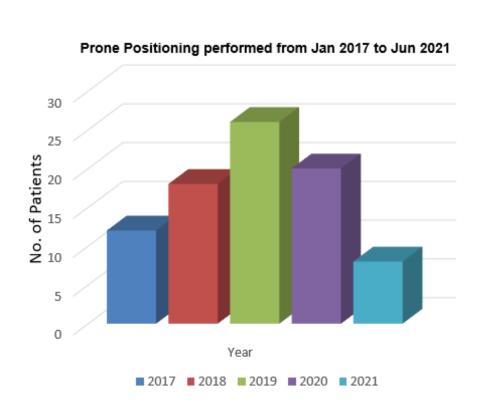


PDCA 3 : Communications, roadshows, audits and yearly competency to sustain improved PP care





Results

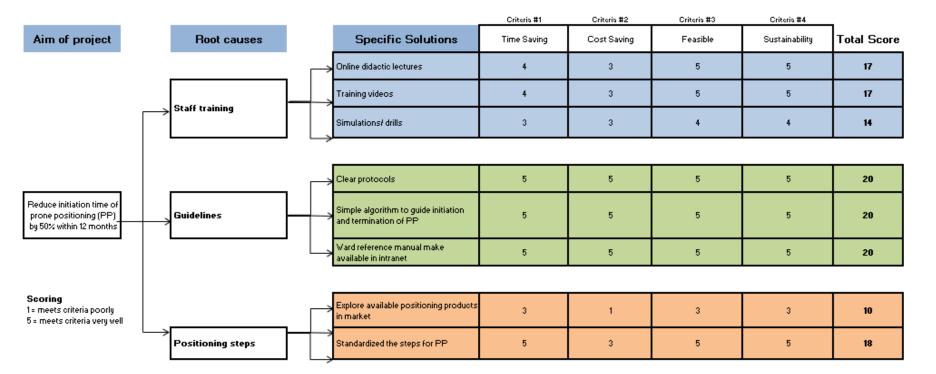


- Yearly increment in numbers of patients on prone position
- 46 patients from Jan 19 to Dec 20 vs 30 patients from Jan 17 to Dec 18

Preparation and Procedure Time for PP

	Pre-Implementation (Hour)	Post-Implementation (Hour)	P-value
Preparation Time (Mean)	0.91	0.28	p-value <0.05
Procedure Time (Mean)	0.5	0.2	p-value >0.05

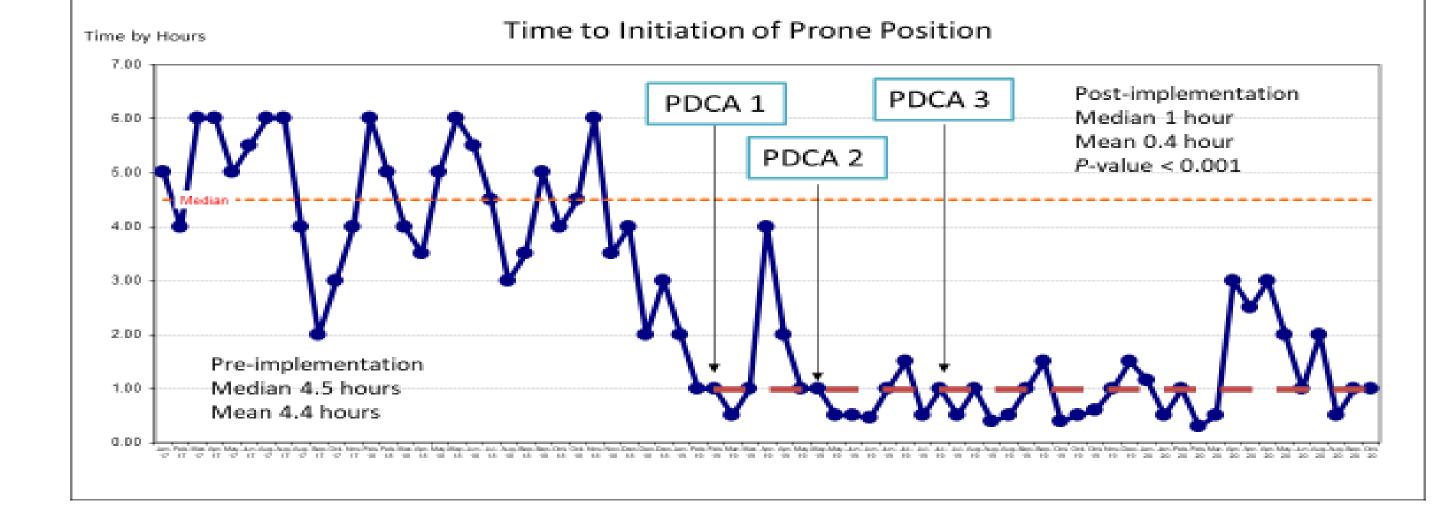
Final solutions: Tree diagram and Prioritization matrix to develop the final solutions

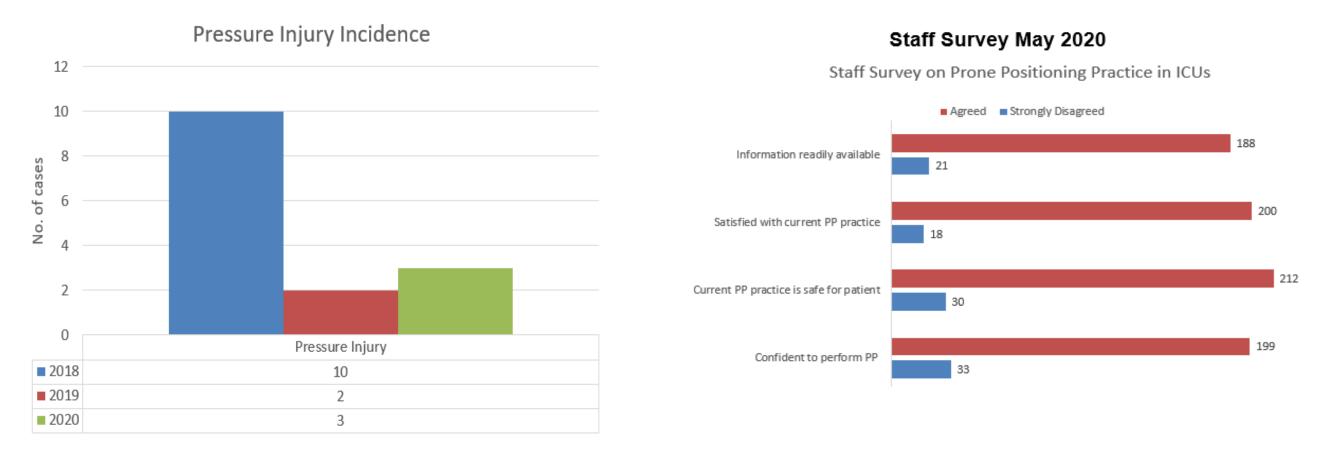


3 Plan-Do-Check-Act (PDCA) cycles implemented

PDCA 1: Guidelines, protocol, checklist and algorithm to guide and standardize practice

	•	 Prone Positioning Checklist Guide 					
	Pre-Procedure	Procedure	Post-Procedure	Monitoring			
	Ensure procedures ordered are performed (e.g. CXR,	Move the ventilator close to the patient's bed.	Check position of ETT and	Review ventilator setting. Record			
	wound dressing, vascular catheter insertion, etc)	Place the patient on a clean sheet with a slide	ventilator parameters	hemodynamic parameters and check ABG one	Singapore General H	lospital	
Prone Positioning for ARDS Algorithm		sheet underneath	· · · · · · · · · · · · · · · · · · ·	hour after prone position	Ward Reference Manual		
raindications stable spine, palvic Moderate/Severe ARDS	Stop NGT feeds 1-hr before turning, aspirate and		Reposition ECG electrodes	····· · · · · · · · · · · · · · · · ·	Title:	Document No: Page 1 of	
• FiO2>0.6	disconnect	Place patient's hand underneath the buttocks with	posteriorly	Monitor neurological status: GCS per shift	Prone Positioning for Acute Respiratory Distress Syndrome (ARDS)	60451-WRM-604	
ble arrhythmia Pa02/FI02 ratio <130mmHg wounds on face, First 48 hours of protective MV		the palms facing anteriorly	·,	and pupillary reaction every 4 hourly and	Issuing Department: Respiratory & Critical Care	Approved By:	
or abdominal	Prepare prone positioning requisites (e.g. Slide sheet,	the pairs racing antenenty	 Check lines and drainage, 	more often as required	Medicine	Dr Phua Ghee Chee	
<63mmHg	2 bedsheets, 2 pillows, 1 face cushions, etc)	Place pillows over the chest, iliac crests and face	ensuring clamps are open,		Date Revised: 1st Oct 2019	Senior Consultant, Head of Departme	
ive raemoptysis	2 bedsheets, 2 phows, 1 lace cushons, etc)	(Omit pillows for patients with BMI <25)	and patient is not lying on	Monitor and titrate sedation, analgesic and/	Version Number: 2		
ome IAP>20 Maintain Supine Position	Airway / mouth care: suction ETT, mouth &	(Onit pinows for patients with Divit \$25)	tubes and lines	or paralytic according to target prescribed	1. PURPOSE		
nancy (2nd/3rd sster)	1.	Place a clean bed sheet on top of the patient	tubes and lines	Assess TOF per shift and more often as			
id obesity /weight	oropharynx		Check the position of the	required. The goal for TOF is 90%	To provide guidelines for prone positioning of patien acute respiratory distress syndrome (ARDS) at the		
Perform Prone Positioning	ETT is taped to the right corner of the mouth.	leaving only the head and neck exposed		blockade (1-2 twitches out of 4)	may be used for the treatment ARDS as a strategy	o improve oxygenation when lung prote	
neostomy <24hrs • Take ABG pre-prone isc pacemaker • Pre-procedure care (sinway, eye, lines, skin, etc)	Insert bite block with padding as needed		pelvis and anterior chest		modes of ventilation fail.		
ted <2 days Perform team brief (assign roles, safety checks, plan)		Roll the edges of the top and bottom bed sheets	pillows, ensuring that the	BIS value between 40 and 60	2. POLICY		
Post-procedure care (sirway, eyes, lines, pillows, etc)	 Eye care: clean and lubricate with Duratears eye 	tightly together, wrapping the patient inside	abdomen is free, face				
	ointment then close eyes with tape		cushion, ETT and NGT are	Monitor feed tolerance. Start trophic enteral	2.1 Physician orders are required for the initiation and d 2.2 Physicians with the ability/ training to intubate are to	iscontinuation of prone positioning there be present when placing the patient in	
ications 2x85% for		Keeping the bed sheets pulled taught and the edges	not creating pressure on	feeding (10mls/hr) and increase feeding as	prone position and/or when returning to supine position	ion.	
Any complications during Yes	 Skin: Cover pressure points and bony prominences 	rolled tight, perform the 3-point turn:	the eyes, nose and ears	tolerated	2.3 An interdisciplinary ICU team should be trained and	skilled to perform the prone positioning	
ncoynamic prone positioning?	with foam dressings (e.g. Mepilex border)				manoeuvre.		
te armythmia t dislotgement/		 Move the patient horizontally to the side of the 	Check the position of the	Assess eyes / face / skin condition 2-4 hourly:	3 DEFINITION		
truction No	Lines: Secure all lines and drains, ensure adequate	bed opposite the ventilator	hands, anterior leg region	Ensure eye lids are closed, lashes are	3.1 ARDS refers to a type of acute diffuse, inflammatory	the later to dealer to be an address	
Maintain Prone Position for 6 hours	length for IVs, IA, CVP and ventilator tubing.		and toes	outside eye and lids free of ointment	vascular permeability, increased lung weight, and lo		
Perform prone position care Take ABG 1 hour and 6 hours post-prone to	position lines above the abdomen towards the	On the call of the airway manager, whilst		Monitor tightness of ETT tape, pressure	within 1 week of a known clinical insult or new or wo	rsening respiratory symptoms. Clinical	
essess response	head of bed and lines below abdomen towards	maintaining a tight grip on the rolled-up sheets	Re-start feed, maintain on	is taken off the eyes and ears, NGT is not	features are PaO2/ FiO2 ratio <300 on minimum PE on chest radiograph and no predominant features of		
	foot of bed, empty drainage bags if applicable	the patient is rotated 90° to lie on lateral position.	reverse Trendelenburg to	pressing on inner nose or face			
·		Recheck airway, lines and vital signs. Perform the	reduce the risk of	Assess skin and pressure points	3.2 Prone positioning refers to putting the patient in the		
e change Did extinct receptes No	Discontinue non-essential infusions and monitoring	hand exchange manoeuvre by placing one hand	aspiration	underneath pillows and bedsheet for	improve respiratory mechanics, homogenize the ple ventilation distribution, increase lung volume and at		
/FiO2 ratio >20mmHg	(e.g. CVP, BIS, NBP, IV maintenance, antibiotics,	on the left side and one on the right side of the	-	potential skin impairment	secretions, and reduce ventilator associated lung in	ury. Prone positioning improves gas	
2>10mmHg	sedation, paralytic, etc)	patient	Ensure infusions are	Ensure male genitalia and catheter are	exchange by ameliorating the ventral-dorsal transpu-	Imonary pressure difference, reducing	

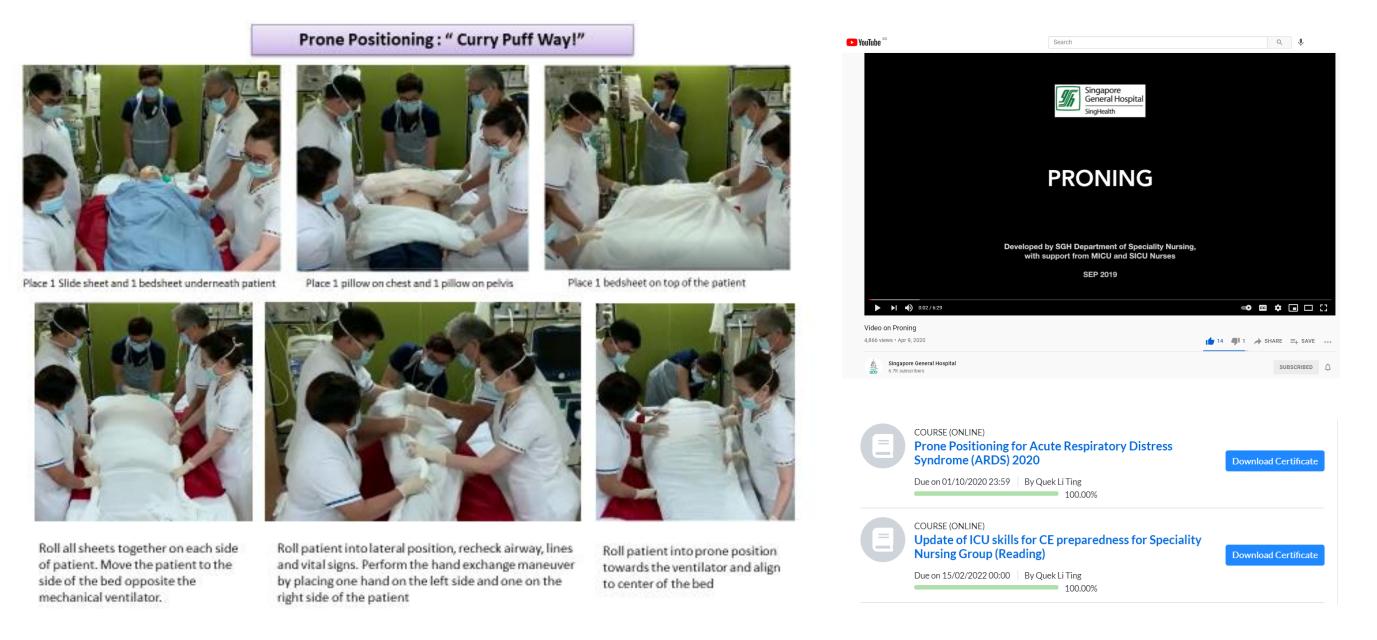




- Median initiation time reduced from 4.5 hrs to 1 hr
- Mean preparation time reduced from 0.91 hrs to 0.28 hrs
- Incidence of pressure injuries reduced by 50%
- Potential cost-saving of \$27,280 or \$5,456 for each pressure injury prevented 3
- Overall, staff were satisfied with current PP practice and felt confident and safe to PP

Maintain Prone Position for 12-16 hours Herrs Thromeore big st 80 dayse Revers Thromeore big st 80 dayse Herrs Thromeore big st 91 dayse Herrs Thromeore big st 91 dayse Herrs Thromeore big st 91 dayse Return to Supine Position Test 440 in hours and resses P/F ratio < 150mmtg? No Note: A405- Acute Regimery bidness Systemer, Po-2 partie longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical vertilistics, A405- Acute Regimery bidness Systemer, Po-2 parties longers Product M-Mechanical Mechanical Based Systemers (Po-2 parties Based Systemers Po-2 parties Based Systemers Based Systemer	 Reposition ECG leads from anterior chest wall to the shoulders and forearms Do team brief and ensure enough staff are available > 1 doctor with intubation skills, 3-4 nurses, RT or doctors Check and record pre-proning ABG, airway pressure, tidal volume, inspiratory pressure and vital signs + Sp02. Pre-oxygenated with Fi02 100% for 10 minutes prior to proning 	 ventilator, align potient to the center of the bed. Position face onto the face cushion (if not on face cushion, turn the head to face the ventilator). Place absorbent pad under the patient's head Remove slide sheet and position head and arms in "swimming" position. Place a pillow under the shins to flex the knees and allow the feet to dangle at a 90 degree Re-connect all lines, re-start feed, ensuring NGT has not been dislodged 	 Restart continuous renal replacement therapy if hemodynamic is maintained Document duration of prone position (e.g. 16 hours) 	 Reposition the arms (and head as well if not on face cushion) every 2-4 hourly to prevent pressure injuries Maintain in reverse Trendelenburg at 30° head up to minimises facial oedema and aspiration 	4 4.1 4.1.1	FIG2 refers to fraction of inspired oxygen ICP refers to increased intracrial pressure ETT refers to endotracheal tube ECG refers to electrocardiography CVP refers to central venues pressure BIS refers to Bispectral index TOF refers to train of four INCLUSION AND EXCLUSION CRITERIA Inclusion criteria Patients with ARDS and severe hypoxemia should be contraindications, after deep sedation and neuromus
--	---	--	--	---	-------------------	---

PDCA 2 : Simplifying the PP steps, online learning, videos and simulation training



Conclusion

Prone positioning helps improve oxygenation and lung recruitment in patients with ARDS. During COVID-19 pandemic, prone positioning was widely used as a low-cost effective way of saving patients' lives. Our project came in time to prepare the ICU teams and train the deployed staff assigned to ramp up ICU capabilities. Combining forces with all intensive care units at SGH, our team developed a systematic approach to perform prone positioning in a safe manner. Together as a big team, we were able to overcome the challenges and associated risks with it. ICU teams' knowledge, skills and confidences to perform prone positioning were greatly enhanced. Early initiation of therapy was achieved.

References:

- 1. Fan E, Del Sorbo L, Goligher EC, Hodgson CL, Munshi L Walkey AJ, et al. An official ATS/ESICM/SCCM clinical practice guideline: mechanical ventilation in adult patients with acute respiratory distress syndrome. Am J Respir Crit Care Med 2017; 195(9): 1253-1263.
- 2. Munshi L, Del Sorbo L, Adhikari NKJ, Hodgson CL, Wunsch H, Meade MO, et al. Prone position for acute respiratory distress syndrome. A systematic review and meta-analysis. Ann Am Thorac Soc 2017; 14(4)(Suppl.): S280-S288.
- Lim, Mei Ling & Yuh, Ang. (2017). Impact of hospital-acquired pressure injuries on hospital costs experience of a tertiary hospital in 3. Singapore. Wound Practice and Research. 25. 42-47.