

## ***What has been reported to date?***

Preshma Percy (2020), Tissue Viability Lead for Kettering General, reported an increase in hospital developed pressure ulcers (PUs) during the COVID-19 pandemic from 0.46 to 0.96 per 1,000 bed days for Category II PUs. This was despite an overall reduction in the number of patients per 1,000 bed days either due to a decreased number of hospital admissions or shorter lengths of inpatient stays.

Percy additionally reports that this trend was reported throughout the East Midlands Tissue Viability Nursing Forum. The suggested contributing factors for this increase in PUs are:

- **Physiological changes related to COVID-19**
- **Increased use of medical devices needed to support treatment**
- **Poor nutrition due to the patient's condition or the health care environment**
- **Decreased mobility due to illness and how the patient needed to be positioned**
- **Workforce challenges**

Gefen and Ousey (2020), report following the EPUAP virtual meeting September 2020, that three important topics were highlighted. These were:

- **Worrying links between the pathophysiology of COVID-19 and the aetiology of PUs**
- **Medical device-related pressure ulcers (MDRPU) and prone positioning both contributing to the state and extent of exposure to sustained tissue deformations of hospitalised COVID-19 patients**
- **The important role of inflammation and inflammation-related tissue damage in the aetiology of PUs**

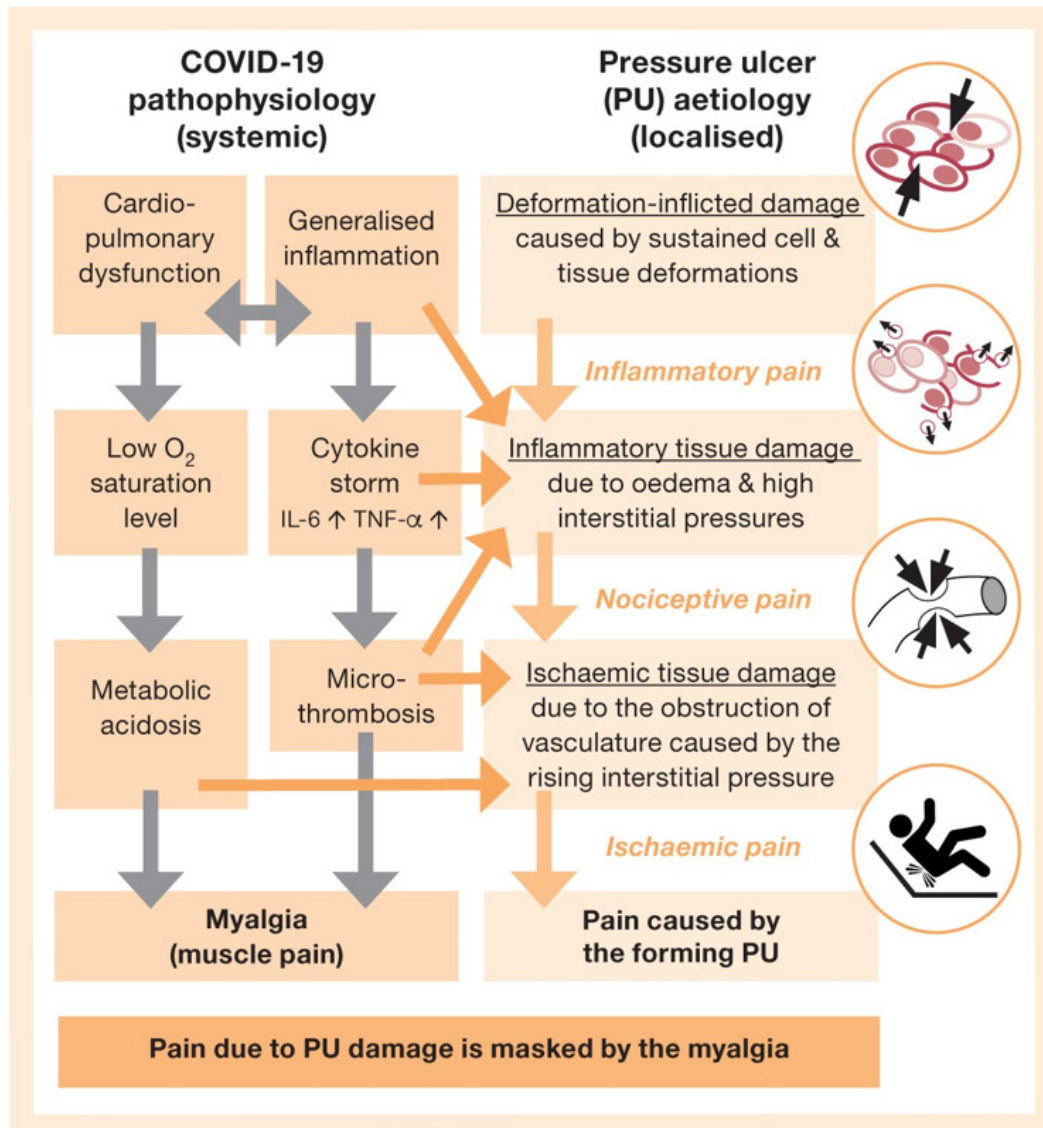
Gefen and Ousey (2020) highlight that a patient's main protective mechanism against tissue damage is discomfort and pain. Usually this would promote a reposition, thus offloading the affected area. However, when due to COVID-19 where patients are either unconscious or unable to communicate this discomfort, the pain goes unnoticed. This causes PU formation due to sustained tissue cell and tissue deformation.

Trevellini (2020), has shown that the prevalence of PUs among confirmed COVID-19 patients who required intensive care was more than three-times greater than the PU prevalence among patients without COVID-19 who similarly needed intensive care.

Gefen and Ousey (2020) highlight the cytokine storm (CS) as one of the most life-threatening complications of COVID-19, often resulting in mortality due to multi-organ failure caused by the immense inflammatory damage.

Inflammation is a key factor in PU development (Gefen et al, 2019) and is fundamentally correlated to pain in general (Gefen and Soppi, 2020), and to pain caused by COVID-19 in particular (Fig 1).

Fig 1.



Gefen. A., Ousey. K., (2020). COVID-19: pressure ulcers, pain and the cytokine storm. *Journal of Woundcare*

The figure above shows that when cells and tissue are heavily loaded or loaded for a prolonged period, cell damage may occur resulting in inflammation. The resulting inflammation reduces blood flow to the affected area leading to cell death. The WHO have shown overwhelmingly that obesity is associated both with a higher risk for intensive care unit (ICU) admission and poorer outcomes for COVID-19 (World Obesity, 2019). This patient group are at increased risk due to loading, clinical instability and staff shortages affecting ability to reposition frequently.

## **Fluid Immersion Simulation**

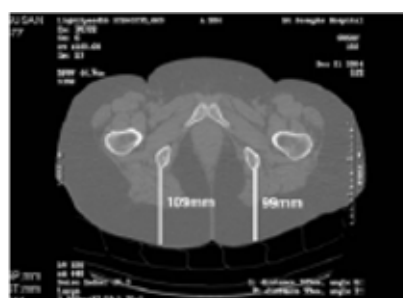
Fluid Immersion Simulation (FIS) and Air Fluidised (AF) Therapy have been compared in a Randomised Controlled Trial (Mendoza et al, 2019). The RCT evidence suggests that the Dolphin FIS is not inferior to the Air Fluidised Bed and costs less. Use of AF beds have been ceased in many Trusts that usually use AF Bed therapy during the Covid pandemic due to the mechanism of action which circulates air through silicone beds, creating the fluid environment, due to fears of cross contamination.

The Dolphin Fluid Immersion Simulation (FIS) therapy system is a reactive mattress system that creates a simulated fluid environment, enabling full immersion and envelopment, significantly reducing pressure, shear and tissue deformation. The mattress is intended to be used by patients with high grade pressure ulcers or those at high risk of developing pressure ulcers. The system is CE marked and is currently in use in many hospitals across the UK.

The benefit of using AF and FIS therapies are due to the provision of a fluid environment in which the patient may be nursed. Fluid environments are of benefit with consideration of both the formation of PUs and Covid patient population as a fluid environment:

- Reduces deformation of soft tissue
- Blood flow to areas that are laid upon are near to normal
- Reduction in damage has been proven to occur

## **Reduced Soft Tissue Deformation:**



### **Medstrom data on file**

The CT scans above taken at St Joseph's Hospital, Tampa FL, demonstrate tissue symmetry of a healthy individual when placed on a foam mattress and on Dolphin Therapy. Distances from the most posterior point of the ischial tuberosities to the skin surface measures **75mm** and **78mm** on a foam surface versus **109mm** and **99mm** in a simulated fluid environment.

## ***Near to Normal Blood Flow:***

Kohanzadeh et al (2019) showed that vascular occlusion to soft tissue that was laid upon was **12.2%** closed on Dolphin Therapy versus **78%** for a gel surface; **97.59%** for standard foam and **98.29%** for an engineered foam surface.

## ***Reduction in Damage:***

Mayes and Melendez (2012) undertook a study to compare AF therapy and FIS for patients undergoing full thickness flap repair following corrective surgery where avoidance of pressure and shear to the graft site was paramount to success of surgery. This study found that where all other aspects of care remained unchanged (other than the ability to elevate the patient head of bed using FIS), outcomes remained unchanged. No acquired instances of pneumonia were found due to ability to elevate head of bed and patients reported less discomfort due to circulation of warm air when AF therapy was used. Financially the specialist hospital reported that Dolphin FIS mattress hire cost \$26,249, for the same period the Air fluidised system would have cost an equivalent \$58,900.

## ***COVID-19 and Dolphin Therapy Clinical Evaluation Report:***

Throughout the United Kingdom, clinical outcomes between 2020 and 2021 have been collected for **21 COVID-19 positive patients nursed on Dolphin Therapy** across five different hospital sites. From this review, **five patients had also been noted as being nursed in the prone position**. The review concluded:

12 patients had previous skin damage. The cumulative amount of skin damage from this group of patients was 18 pressure ulcers. Final outcomes determined:

- **11% of pressure ulcers healed**
- **39% of pressure ulcers improved**
- **50% of pressure ulcers remained static**

*Note: Only one proned patient had existing skin damage. This was recorded as a Category III on the sacrum (i.e. not in contact with Dolphin Therapy) and it remained static.*

9 patients (including 4 proned patients) did not have existing skin damage. Final outcomes determined:

- No patients acquired new skin damage on Dolphin Therapy (therefore **100% effective at prevention of pressure ulcers**)

Patients also had additional objectives selected such as improvement in comfort, improvement in pain, improvement in sleep, improvement in concordance and reduced turning. For all objectives, it was noted that Dolphin Therapy met the objective fully (100%).

## ***Relevance of FIS for a Proned Patient:***

Over the last 12 months due to the physiological changes related to COVID-19 has resulted in a surge of patients with acute respiratory distress syndrome. Prone positioning may be used in such patients to optimise oxygenation. Severe infections may leave survivors with significant functional impairment necessitating rehabilitation. Those who have experienced prolonged prone positioning are at increased risk for complications not typically associated with critical illness.

This includes complications such as:

Intubated patients placed in prone position are at risk for endotracheal obstruction and impaired mucus clearance.

- Facial oedema and ocular complications have also been reported in patients who have been put in prone position for surgical procedures and/or respiratory failure
- Patients placed in prone position in intensive care settings are at increased risk for pressure injuries in comparison with those kept in supine position, and their injuries may occur in uncommon, locations. Anatomical locations exposed to prolonged pressure such as cheekbones and the anterior thorax often related to devices and Oedema. Other sites include the iliac crests, breasts, scrotum ribs and knees.
- Over the last 12 months the fluid immersion simulation created by the Dolphin surface has been shown (anecdotally) to reduce issues in point 3. The simulated fluid environment conforms completely around the patients face, chest and body (like water) spreading load across the surface area of the body and minimising peak pressures on vulnerable swollen facial skin, as well as somewhat alleviating the pressure that a device creates that sits between the patient and the surface (e.g., ET tube or catheter).

This we believe is due to the fluid surface that immerses the device and envelops it with the patient's morphology (like fluid), therefore reducing the points of pressure that would normally be created by a device against vulnerable skin. This does not take away from the need to check skin under devices, but it may allow longer spells between skin checks as we have evidenced in patient outcome data detailed above.

## References:

- Gefen. A., Brienza. D., Edsberg. L., et al (2019). The Aetiology of Pressure Ulcers. In European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), Pan Pacific Pressure Injury Alliance (PPPIA) Prevention and treatment of pressure ulcers/injuries: clinical practice guideline (3rd edition). [www.internationalguideline.com](http://www.internationalguideline.com), 2019.
- Gefen. A., Ousey. K., (2020). COVID-19: pressure ulcers, pain and the cytokine storm. *Journal of Woundcare* [online]. Vol. 29, No. 10. [viewed 20 February 2021]. Available from: <https://doi.org/10.12968/jowc.2020.29.10.540>
- Gefen. A., Soppi. E. (2020). What is new in our understanding of pressure injuries: the inextricable association between sustained tissue deformations and pain and the role of the support surface. *Wound Practice and Research*. 28(2). Pages 58–65
- Mayes K. L., Melendez. J., (2012) Care without clinical compromise: Incorporating the Dolphin Fluid Immersion Simulation mattress system into the post operative care of patients undergoing myocutaneous flaps. Poster presented at: Clinical Symposium on Advances in Skin & Wound Care, 20–23 Oct 2012, Las Vegas, US. [https://www.joerns.com/user\\_area/spec\\_sheets/Sparrow-Dolphin-Cost-Effective-Care-Study-punch.pdf](https://www.joerns.com/user_area/spec_sheets/Sparrow-Dolphin-Cost-Effective-Care-Study-punch.pdf)
- Kohanzadeh. S., Breithaupt. A., Bondorchuk. A., et al (2012) Effectiveness of the Biologics™ Dolphin bed as a tool to improve tissue perfusion in points of compression. Poster presented at: Clinical Symposium on Advances in Skin & Wound Care, 20–23 Oct 2012, Las Vegas, US.
- Mendoza.R.A., Lorusso. G.A., Ferrer. D.A., Helenowski. I.B., Liu. J., Soriano. R.H., Galiano. R.D., (2019). A prospective, randomised controlled trial evaluating the effectiveness of the fluid immersion simulation system vs an air-fluidised bed system in the acute postoperative management of pressure ulcers: A midpoint study analysis. *International wound journal*; 2019;1-11
- Percy. P., (2020). Initial observation on pressure ulcers and COVID-19. *Wounds UK*. Vol 16. No 4. Pg 45-47.
- Trevellini. C., (2020). Challenges faced with morbidity obese patients during COVID-19. [presentation]. The 2020 Virtual Meeting of the European Pressure Ulcer Advisory Panel (EPUAP) [viewed 20 February 2021]. Available from: [https://www.epuap.org/wp-content/uploads/2020/09/epuap2020-virtual-abstract-book.qxp\\_sestava-1.pdf](https://www.epuap.org/wp-content/uploads/2020/09/epuap2020-virtual-abstract-book.qxp_sestava-1.pdf)
- World Obesity., (2019). Obesity and COVID-19: Policy statement. [viewed 20 February 2021]. Available from: <https://www.worldobesity.org/news/obesity-and-covid-19-policy-statement>
- The down side of Proning. Le, Minh Quan MD; Rosales, Richard MD; Shapiro, Lauren T. MD, MPH; Huang, Laura Y. MD. Author Information. *American Journal of Physical Medicine & Rehabilitation*: October 2020 - Volume 99 - Issue 10 - p 870-872