

# Pressure injury after COVID-19 treated with adjuvant laser therapy: a case study



*Lesão por pressão após COVID-19 tratada com laserterapia adjuvante: estudo de caso*

*Lesión por presión después de COVID-19 tratada con terapia con laser adyuvante: estudio de caso*

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## ABSTRACT

**Objective:** To report adjuvant laser therapy treatment in a pressure injury patient after COVID-19.

**Method:** A case report carried out at the ambulatory of a university hospital in southern Brazil.

**Results:** The nursing diagnosis of pressure injury was primarily listed. The result Wound Healing: secondary intention was used, as well as four clinical indicators: granulation, decreased wound size, scar formation and exudate were evaluated. Nursing interventions were implemented which led to a satisfactory evolution of the case.

**Conclusion:** Using laser therapy and the results evaluation and indicators in the follow up of a patient with pressure injury due to COVID-19 showed up as an accurate tool to clinical practice, improving patient safety and quality care.

**Keywords:** Nursing process. Pressure ulcer. Coronavirus infections. Standardized nursing terminology.

## RESUMO

**Objetivo:** Relatar o tratamento por laserterapia adjuvante em paciente com lesão por pressão após COVID-19.

**Método:** Estudo de caso realizado no ambulatório de um hospital universitário no Sul do Brasil.

**Resultados:** Elencou-se prioritariamente o diagnóstico de enfermagem Lesão por Pressão. O resultado Cicatrização das feridas: segunda intenção e quatro indicadores clínicos: Granulação, Tamanho da ferida diminuído, Formação de cicatriz e Exsudato foi avaliado. Foram implementadas intervenções de enfermagem, que levaram à evolução satisfatória do caso.

**Conclusão:** A utilização da laserterapia e a avaliação dos resultados e indicadores no acompanhamento ambulatorial da paciente com lesão por pressão, em decorrência da COVID-19, mostrou-se acurada à prática clínica, aprimorando a segurança e qualidade do cuidado.

**Palavras-chave:** Processo de enfermagem. Lesão por pressão. Infecções por coronavírus. Terminologia padronizada em enfermagem.

## RESUMEN

**Objetivo:** Informar tratamiento adyuvante con terapia láser en un paciente con lesión por presión después de COVID-19.

**Método:** Estudio de caso realizado en el ambulatorio de un hospital universitario del sur de Brasil.

**Resultados:** El diagnóstico de enfermería de lesión por presión fue principalmente listado. Se evaluó el resultado de la cicatrización de la herida: segunda intención y cuatro indicadores clínicos: Granulación, Disminución del tamaño de la herida, Formación de cicatrices y Exudato. Se implementaron intervenciones de enfermería, lo que condujo a la evolución satisfactoria del caso.

**Conclusión:** El uso de la terapia láser y la evaluación de resultados e indicadores en el seguimiento ambulatorio de pacientes con lesión por presión, debido a COVID-19, demostraron ser precisos para la práctica clínica, mejorando la seguridad y localidad de la atención.

**Palabras clave:** Proceso de enfermería. Úlcera por presión. Infecciones por coronavirus. Terminología normalizada de enfermería.

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## INTRODUCTION

COVID-19 is a systemic disease caused by SARS-CoV-2 infection in the respiratory tract, generating metabolic and inflammatory responses from the cellular level to the organ systems<sup>(1)</sup>. It is believed that endothelial dysfunction induced by SARS-CoV-2 infection results in a pro-inflammatory and pro-thrombotic state, leading to microvascular occlusion with inevitable skin manifestations<sup>(2,3)</sup>. Patients with severe COVID-19 had hemodynamic and/or respiratory instability were submitted to mechanical ventilation, analgesia and prolonged neuromuscular blocking, which resulted in physical immobility and vascular impairment, increasing the incidence of pressure injuries (PI)<sup>(4)</sup>.

Pressure injuries can be classified into stages, as follows: stage 1 – non-blanchable erythema of intact skin; stage 2- partial-thickness loss of skin with exposed dermis; stage 3- full-thickness loss of skin; stage 4- full thickness loss of skin tissue; unstageable: full-thickness loss of skin tissue that is obscured<sup>(5)</sup>. Regarding the treatment and prevention of PI, nursing care is crucial, especially with the use of new technologies, such as low-level laser therapy (LLLT), which can provide better results in healing and pain relief<sup>(6,7)</sup>, through photochemical effects on irradiated tissues. The use of these technologies, however, requires training, according to Resolution No. 567/2018 of the Federal Nursing Council (COFEN)<sup>(8)</sup>.

During the nursing appointment, to assist in the evaluation of the process of wound healing, nurses can use instruments for measuring the results achieved after the interventions performed. In this regard, the Nursing Outcomes Classification (NOC) allows the evaluation of results in different scenarios of clinical practice<sup>(7,9,10)</sup>.

Recent investigations on the care of PIs in individuals assisted in outpatient care, showed that adjuvant LLLT had significant results<sup>(7,10-12)</sup>. This evidence motivated the authors of this article to expand the use of this technology in patients affected by pressure injuries after prolonged hospitalization for the treatment of COVID-19, in an outpatient follow-up, in order to obtain better results. The following research question was then proposed: which was the outcome observed in a patient with pressure injuries due to prolonged hospitalization for treating COVID-19, after sessions of adjuvant low-power laser therapy, according to NANDA – International, Nursing Intervention Classification and Nursing Outcomes Classification?

Thus, the present study aims to report the treatment with adjuvant laser therapy in a patient with pressure injury after hospitalization for treating COVID-19.

## METHOD

This is a case study<sup>(13)</sup> based on the nursing process and NANDA-I, NIC and NOC<sup>(9,14,15)</sup> classification systems, carried out at the Psychiatry and Rehabilitation Ambulatory Service of a university hospital of high complexity, in southern Brazil. The study is focused on pressure injury (PI) healing, training of mobility and muscle pain relief, with assistance provided by a multidisciplinary team.

Data collection for the assessment of the injury was carried out by two nurse researchers with experience in treating injuries in outpatient settings, trained to use the instrument that included the NOC outcome C “Wound healing: Secondary intention” (1103) with four indicators: granulation, decrease in wound size, scar formation and exudate. These indicators were selected by the researchers based on their clinical practice and studies on the subject<sup>(7,10)</sup>. Conceptual and operational definitions were used, contemplating the magnitude in the five-point Likert-type scales, where 1 is the worst score and 5 the best, which allows an objective and reliable evaluation<sup>(7,9)</sup>. The score assigned to each of the indicators was a consensus among the nurse researchers.

The instrument was applied immediately before each LLLT intervention with an interval of fifteen days, in a period of ninety days, in a total of seven applications. The protocol was used with the application of 1J of red laser and 1J of infrared laser (technique of points in the wound, on the edges and on the perilesional skin, totaling 80 points with gradual reduction as regeneration occurs until healing). The photographic record at a distance of 40 cm from the wound was carried out with the aid of a mobile phone with an IOS platform, and a white moving sheet was used as background.

The application of the LLLT intervention was carried out by the same nurses, duly trained for its use, following the recommendations of the phototherapy protocol, by means of the Therapy EC laser by DMC® – Power of 100 mW, wavelength of 660 and 808 nanometers. Protection was used by the patient and the professionals during the application of the therapy.

In this phase, treatment included cleaning the wound and performing instrumental debridement and using papain diluted 10% with non-adherent gauze and dressings.

At home, the patient was instructed to perform the dressing daily, which included cleaning the wound with warm saline solution at 0.9% in a jet, compresses with liquid polyhexanide solution (PHMB) and application of dressings as indicated. Psychoeducation was carried out for early body mobilization, use of pillows and cushions, skin hydration, healthy and nutritious food and adequate fluid intake.

Descriptive statistical analysis of the data was carried out, considering the NOC scores, to allow the identification of factors that could corroborate or contradict the improvement in the healing process of the PI. Ethical aspects were observed at all stages of the study, in accordance with Resolution No.466, of December 12, 2012, which deals with the recommendations that regulate research involving human beings<sup>(16)</sup>. The study was approved by the Ethics Committee of the institution under Protocol no 10-0505.

## Case description

A 28-year-old patient with polyneuropathy, a past history of depression, hypertension, chronic renal failure and complications from severe COVID-19. Prolonged hospitalization of 90 days, 57 of them in the Intensive Care Unit, where she required mechanical ventilation and prone position. After hospital discharge, the patient was referred to the rehabilitation outpatient clinic and two weeks later, she received the aforementioned care.

At the outpatient clinic, the woman arrived in a wheelchair, breathing spontaneously with no disorder in vital signs. There was an extensive PI in the sacral region, cavity, irregular borders, a bed with a predominance of granulation tissue and 20% of liquefaction necrosis in the deeper central portion. Measurement: 10.3 x 7 cm, depth 6 cm and 2 tunnels of 3 cm. No bone exposure and signs of infection. Low sodium diet and fluid restriction. She was undergoing hemodialysis three times a week through an arteriovenous fistula in her left arm. Anuric. Daily evacuation with soft stools. Hydrated skin. Reduced strength and hypoesthesia in the fingers (left hand) and toes (left foot). She required temporary assistance with walking.

## ■ RESULTS

### Planning of care

After data collection, the nursing diagnosis (ND) Pressure Injury<sup>(14)</sup> was listed as a priority. For goal setting and assessment of LLLT on the healing process, the outcome Wound healing: Secondary intention<sup>(1103)</sup> was established with four indicators: Granulation, Decrease in wound size, Scar formation and Exudate<sup>(9)</sup>, measured using the 5-point Likert scale. The patient's assessment, as well as the application of the intervention, was a consensus among the nurses

responsible for the case. Before the intervention, the patient presented: wound size = score 2; granulation and scar formation = score 3; exudate = score 4. For all of them, the established goal was to reach a score of 5 on the Likert scale, that is, the best possible result.

In order to achieve the established goals, nursing interventions were implemented based on the NIC and the nurses' prior knowledge in the treatment of PI, with emphasis on the LLLT as an adjuvant. Thus, the interventions applied were related to Injury Care (3660), both in performing the dressing in the outpatient environment and in the guidelines for maintenance and prevention of complications in performing the dressing at home, as mentioned above.

Adjuvant laser therapy was used to accelerate scar tissue regeneration, taking into account the intervention of the NIC Laser precautions (6560) according to the institution's protocol. 35 points of 1J of red and 1J of infrared were used concomitantly in the wound bed, 25 points of 1J in the surrounding skin and 8 points of 1J of infrared in the scar of a micropore wound in the low back. Also, psychoeducation was used to prevent pressure ulcers (3540), due to the risk of new wounds.

### Evaluation of the results

The evaluation of the indicators showed that the implemented nursing interventions led to a successful wound healing process in all evaluations (Table 1).

## ■ DISCUSSION

This study was conducted by outpatient nurses, who received the first patients after discharge from hospital with post-COVID-19 sequelae in the Rehabilitation Service. NANDA – I, NIC and NOC (NNN) taxonomies<sup>(9,14,15)</sup> were used in the follow-up of the appointments occurred since hospitalization. During the first two years of the COVID-19 pandemic, the institution documented an up to threefold increase in the occurrence of PIs. The patient selection criterion considered the fact that it was the first patient referred who had these characteristics. In this study scenario, knowledge was transferred through the exchange of experiences between professors and students at the University and nurses regarding the use of LLLT and the application of the NOC to assess tissue regeneration in clinical practice<sup>(12)</sup>. Thus, there was awareness and training for such measurement.

**Table 1** – Evaluation at the ambulatory or PU for the outcome Wound Healing: Secondary intention of NOC. Porto Alegre, Rio Grande do Sul, Brazil, 2022

Indicators	Day 1	Day 15	Day 30	Day 45	Day 60	Day 75	Day 90
Granulation*	3	4	4	5	5	∅NA	∅NA
Decrease in wound size*	∅NA	2	2	3	4	5	5
Scar formation*	3	3	3	4	4	5	5
Exudate†	4	4	4	4	5	5	5

Source: Study data, 2022.

\* 1=None: no granulation tissue; 2=Limited: small area of granulation tissue in one region; 3=Moderate: area of granulation tissue in one region; 4=Substantial: area of granulation at the edges and in the center; 5=Extensive: completely covered granulation.

† 1=Extensive: purulent exudate; 2=Substantial: bloody exudate; 3=Moderate: serosanguineous exudate; 4=Limited: serous exudate; 5=None: absence of exudate, transudate only.

∅NA: Not Applied (Granulation) = This indicator was not applied in the 6<sup>th</sup> and 7<sup>th</sup> evaluations, as from these evaluations on tissue repair evolved with the presence of epithelization tissue.

∅NA: Not applied (Decrease in wound size) = This indicator was not applied in the first evaluation due to lack of comparable data.

The use of LLLT adjuvant therapy in the treatment of LP and the application of the NOC to assess the evolution of therapy reliably demonstrated the achievement of pre-established goals in an outpatient setting. The use of Wound Healing: Secondary Intention outcome indicators (1103) showed positive evolution, during nursing appointments, in performing dressing and LLLT, which was corroborated by a significant reduction in the size of the LP. This outcome was similar to that found in a study that evaluated the healing of PI in a post-COVID-19 patient treated at a rehabilitation hospital, which reinforces the importance of the use of this technology by nursing<sup>(17)</sup>.

The PI tissue regeneration process was also observed by the indicators Scar Formation, granulation and exudate, which presented better scores throughout the patient's follow-up. This evolution can be partly explained by the fact that LLLT accelerates the tissue regeneration process by inducing cellular and molecular changes, such as the production of cytokines and growth factors, responsible for tissue repair phases<sup>(18)</sup>.

In the case described, chronic kidney disease and hypertension may have increased severity of COVID-19 in this patient. Nevertheless, a positive outcome in the evolution of PI was possible, probably corroborated by the actions and guidelines provided in nursing appointments regarding skin care and reduction of pressure on bony prominences, which are known to increase the risk for PI<sup>(5)</sup>.

Moreover, the progression of wound healing may have been favored by periodic dressing, cleaning and debridement,

as well as guidance on PI care<sup>(5)</sup>, which must be understood by the patient and family, to ensure continuity of proper care at home. The importance of adequate nutrition should also be mentioned, despite the water restriction due to the patient's chronic kidney disease<sup>(5)</sup>.

Few studies have been found on the rehabilitation of patients with PI after COVID-19 in outpatient follow-up and with a care plan based on the NANDA taxonomies – International Nursing Intervention Classification and Nursing Outcomes Classification. It is expected, therefore, that the findings of the present article contribute to the expansion of this knowledge, in addition to encouraging further investigations.

## CONCLUSION

The planning and implementation of care for the patient with PI after hospitalization due to COVID 19 supported by nursing classifications proved to be an important ally in monitoring the outpatient case. Due to the nurses' previous experiences with this type of injury, the application of LLLT led to a reduction in the healing time of the LP, and the evaluation of the NOC results provided a better visualization of important evidence in the patient's recovery, adding quality to the care, in addition to subsidizing teaching and stimulating further research in the area. After the first positive experiences with laser therapy, the use of this treatment began to be expanded to the various patients with skin wounds treated at the service.

In addition, the present study supported the acquisition of more laser therapy devices by the institution and reinforced the benefit of this technology in optimizing healing, reducing treatment time and costs.

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