

Low-dose Radiotherapy for Unstageable Pressure Ulcer: A Case Report

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Case report

Keywords: Unstageable Pressure Ulcer, Low-dose radiotherapy

Posted Date: January 4th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-137232/v1>

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Abstract

Background Pressure ulcer is a common complication of long-term bedridden patients, but current treatment strategies have limited efficacy for pressure ulcer.

Case presentation We present a 17-year-old man with unstageable pressure ulcer treated with three-dimensional conformal radiotherapy. We irradiate the posterior lumbosacral pressure ulcer with 3D-CRT using a 6 MV photon beam. The patient was placed in a prone position and a total dose of 50cGy was administered. Then, the healing was evaluated using PUSH scale score on days 8–12 and 3 months after radiotherapy. After radiotherapy, beefy red tissue with a shiny, moist, granular appearance tissue are present in the wound bed, exudate amount was decreased, the depth of the pressure ulcer became significantly shallower and the wound surface area was reduced. PUSH scale score decreased from 15 to 7.

Conclusion: Radiotherapy could be a promising treatment strategy of unstageable pressure ulcer.

Introduction

Patients in long-term bedridden are at high risk of developing pressure ulcers, which contribute to a prolonged and complicated path to recovery(1). The prevalence of pressure ulcers in hospitals range from 2.7 to 29.5%. pressure ulcers also significant costs to the health system. The treatment cost is estimated at \$ 2000 to \$ 25,000 per individual per year(2). But current treatment strategies have limited efficacy for pressure ulcer, especially for unstageable pressure ulcer. It is a challenge to explore new treatment methods.

Radiotherapy is an essential method of malignancy treatment. It was reported that low doses of ionizing radiation can alleviate inflammation, regulate cytokine levels, reduce proinflammatory signaling pathway and increase skin wound healing(3). At low doses, ionizing radiation activates endothelial cells and promotes angiogenesis(4). Low-dose radiation may emerge as a new modality in the treatment of pressure ulcers.

We report a case of a unstageable pressure ulcer treated with three-dimensional conformal radiotherapy, which seems to be effective.

Case Presentation

We present a 17-year-old man who was diagnosed as "central nervous system teratoma" more than half a year ago, with symptoms of numbness and weakness of both lower limbs. The patient was bedridden since December 2019, accompanied by dysuria and fecal incontinence. In February 2020, an erythema of 8 cm X 5 cm was found in the lumbosacral area during chemotherapy. The erythema was red, without itching and pain, diagnosed as "stage I pressure ulcer"(5). The pressure ulcer was disinfected, changed dressings regularly, without other special treatment. In July 2020, the patient was given whole brain and

spinal cord radiotherapy for central nervous system teratoma in our department. The pressure ulcer in the lumbosacral area had formed a circular cavity with a size of 3 cm X 3 cm. There are tan necrotic tissue that adheres to the wound bed, with heavy amount of exudate, without itching, pain or granulation tissue covered. The PUSH scale score was 15(6) (Fig. 1). The pressure ulcer was treated with iodophor disinfection plus the external application of sulfadiazine regularly, but the wound heals poorly. On July 25th, the patient had a high fever during the radiotherapy suddenly, with a body temperature of 40.1 degrees Celsius. Laboratory results showed C-reactive protein [(CRP) 242.97 mg/liter, normal:0–7 mg/liter], Procalcitonin[(Pit) 1.500 ng/ml, normal: <0.150 ng/ml], and white blood cell count[(WBC) $6.4 \times 10^9/L$, normal: $4–10 \times 10^9$]. The increased values of the inflammation index suggested the possibility of pressure ulcer co-infection. There was no decrease in body temperature after Levofloxacin combined with ornidazole and Supushen were used for anti-infection treatment. So the anti-infective drugs were upgraded to Tyneng combined with levofloxacin, then the body temperature decreased gradually. Laboratory results showed C-reactive protein [(CRP) 103.12 mg/liter, normal:0–7 mg/liter], Procalcitonin[(Pit) 0.517 ng/ml, normal: <0.150 ng/ml], and white blood cell count[(WBC) $12 \times 10^9/L$, normal: $4–10 \times 10^9$], indicated the treatment was effective. However, the uncured pressure ulcer was still a potential source of infection. On July 30th, after obtained informed consent, we tried to irradiate the posterior lumbosacral pressure ulcer with 3D-CRT using a 6 MV photon beam. The patient was placed in a prone position and a total dose of 50 cGy was administered (Fig. 2, 3).

Results

8 days after treatment, there was obvious granulation tissue growth in the wound bed, exudate amount was decreased with a PUSH score of 11(6) (Fig. 4). 12 days after treatment, the size of the wound surface area was reduced to 3 cm X 2 cm, beefy red tissue with a shiny, moist, granular appearance tissue are present in the wound bed, with none amount of exudate and PUSH score of 9(Fig. 5). 3 months after 0.5 Gy low-dose radiotherapy, the depth of the pressure ulcer became significantly shallower, wound surface area had shrunken into 2 cm X 1.5 cm with a PUSH score of 7. The wound has a clear tendency to heal, low-dose radiotherapy seems to be effective.

Discussion

Pressure ulcer is one of the common complications of long-term bedridden patients, its incidence rate is as high as 3–11% among hospitalized patients(7). Patients with pressure ulcer have increased infection, mortality rate and medical burden, especially for unstageable pressure ulcer. Current treatments for pressure ulcer include traditional surgical debridement, flap reconstruction, pressure-relieving devices, local growth factor(8, 9). Since the unstageable pressure ulcer appear to be highly resistant to all the above treatments (10), it is a challenge to explore new treatment methods.

At the molecular level, failure of wound healing may result either from insufficient supply or functional inhibition of growth factors such as vascular endothelial growth factor (VEGF) (11). Recent studies revealed that tissue repairing might be enhanced by low dose irradiation through up-regulation of the

level of VEGF(12). Jabbari concluded that gamma-ray irradiation is effective for the acceleration of wound healing(13). However, there is no basic or clinical research of low-dose radiation in the treatment of pressure ulcer. Here we report a case of unstageable pressure ulcer with low-dose radiation treatment in our department. After 0.5 cGy/1f radiotherapy, there was obvious granulation tissue growth in the wound bed, decreased size of wound surface area, reduced amount of exudate, with PUSH scale score decreased from 15 to 7.

In conclusion, low-dose radiation may play an important role in the treatment of unstageable pressure ulcer. Further studies are required to identify the therapeutic effect and determine the optimal dose of low-dose radiation.

Abbreviations

PUSH: pressure ulcer scale for healing; CRP: C-reactive protein; Plt: Procalcitonin; WBC: $6.4 \times 10^9/L$; VEGF: vascular endothelial growth factor.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable

Authors' contributions

BX, RZ and XL participated in paper editing. YL wrote the manuscript. MM, BG, SS, GS participated in data collection.

Acknowledgements

Not applicable

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Figures



Figure 1

the Pressure ulcer shape of the lumbosacral area. (before radiotherapy)

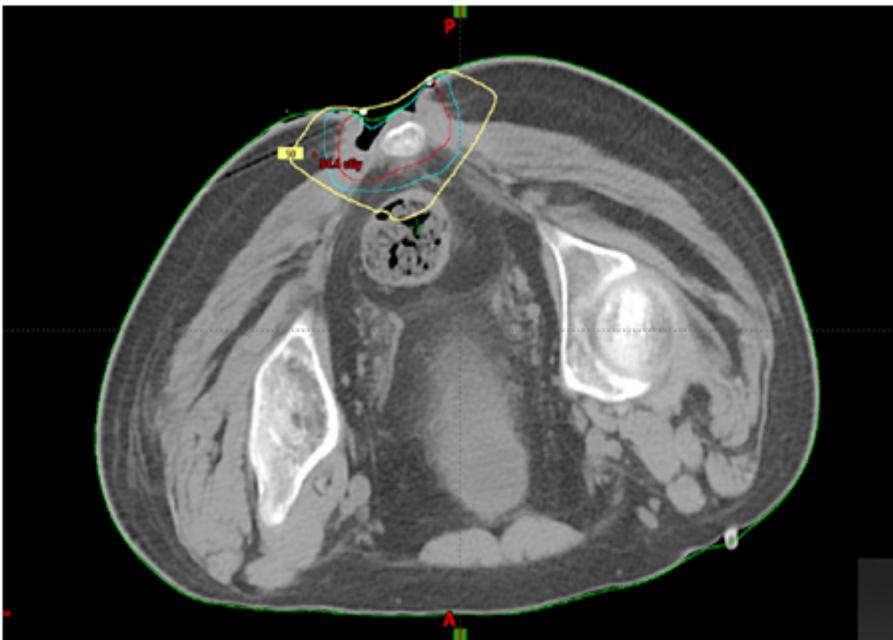


Figure 2

The three-dimensional conformal radiotherapy. The prescribed radiation dose was 50 Gy (the red line represents GTV, the yellow line represents CTV, and the blue line represents PTV).

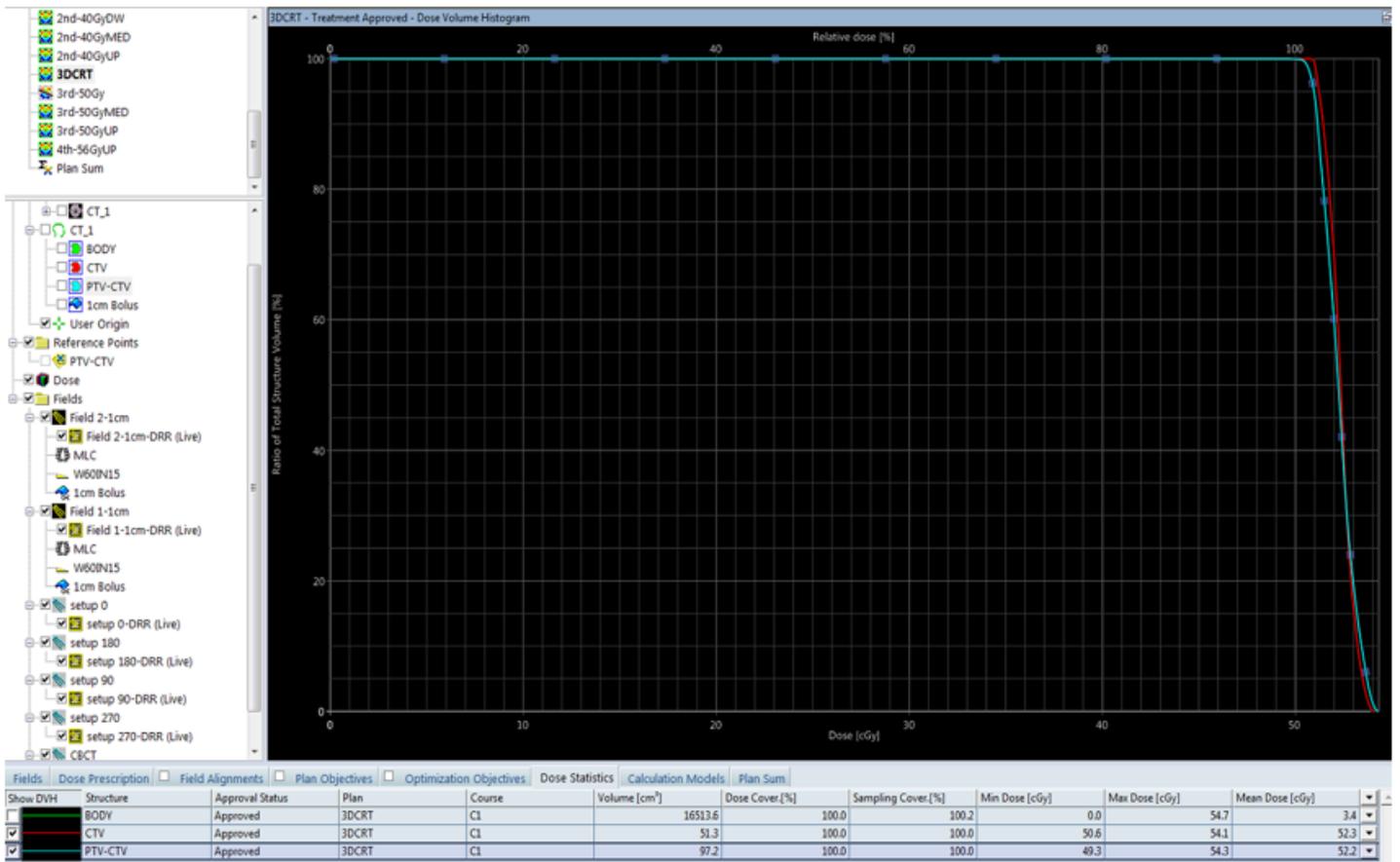


Figure 3

The DVH diagram of the three-dimensional conformal radiotherapy.



Figure 4

the Pressure ulcer shape of the lumbosacral area. (8 days after 0.5Gy low-dose radiotherapy)



Figure 5

the Pressure ulcer shape of the lumbosacral area. (12 days after 0.5Gy low-dose radiotherapy)