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Research Article

Urinary 8-OHdG: A Potential Tool for Early Detection and Risk Estimation in Breast Carcinoma

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Abstract

This research explores the potential of urinary 8-OHdG as a biomarker for early cancer detection and risk estimation. It aims to understand its correlation with breast cancer risk and its predictive value. The findings could contribute to developing non-invasive, cost-effective methods for early detection and risk stratification. The study investigated the potential of urine 8-OHdG as a method for early breast cancer risk assessment and diagnosis. Thirty participants were selected from Bangladesh Medical University, Dhaka, and their urine samples were collected by maintaining proper way and data were analyzed by SPSS version 27. Ethical issues were prioritized, with participants provided counseling and written informed consent. The study explores the relationship between urinary 8-OHdG levels and various breast cancer tumors, clinical parameters, and prognosis. The cohort is predominantly women, with a mean age of 48.7 years. Urinary 8-OHdG levels are associated with risk factors like oestrogen replacement therapy, obesity, postmenopausal state, and multiparity. Larger levels are linked to higher histological grades and positive lymph node involvement. The results suggest urine 8-OHdG's potential as a biomarker for breast cancer.

Keywords: Urinary 8-OHdG; Potential Tool; Early Detection; Risk Estimation; Breast Carcinoma

Introduction

One of the biggest causes of cancer-related death for women globally is still breast cancer [1]. For breast cancer patients to receive effective care and experience better results, early detection and precise risk assessment are essential [2]. The search for new biomarkers is necessary because existing diagnostic techniques frequently fall short of the sensitivity and specificity needed for early detection. Urinary 8-hydroxy-2'-deoxyguanosine (8-OHdG) is one of the newly developed biomarkers that has drawn interest due to its possible applications in early cancer diagnosis and risk assessment [3]. A measure of oxidative DNA damage, 8-OHdG reflects the total amount of oxidative stress that cells have to endure. Oxidative stress is a major factor in carcinogenesis because it causes genomic instability and DNA damage, two conditions that are essential for the development of cancer [4]. This research aims to investigate the role of urinary 8-OHdG as a potential tool for early detection and risk estimation in breast carcinoma. By analyzing urinary levels of 8-OHdG in a cohort of participants, we seek to elucidate its correlation with breast carcinoma risk and its predictive value in identifying individuals at heightened risk of developing the disease. Additionally, we aim to explore the feasibility of incorporating urinary 8-OHdG assessment into existing screening protocols for breast cancer. The findings of this study have the potential to contribute to the development of non- invasive, cost-effective, and reliable methods for early detection and risk stratification in breast carcinoma. Ultimately, the integration of urinary 8-OHdG assessment into clinical practice could lead to improved outcomes through earlier diagnosis and personalized management strategies for individuals at risk of breast cancer.

Methods

This study's main goal was to investigate the possible applications of urine 8-hydroxy-2'-deoxyguanosine (8-OHdG) as a promising method for breast cancer risk assessment and early diagnosis. The study, which was carried out from March 2023 to February 2024 at Bangladesh Medical University in Dhaka, involved the Departments of Laboratory Medicine, Surgery, and Pathology. The study included thirty individuals who had been diagnosed with breast cancer. A purposeful non- randomized sampling technique was used to select the sample size. Important factors that were carefully taken into account during the analysis included alcohol use, parity, age at menarche, menopause status, obesity, and urine 8-OHdG levels. A comprehensive physical examination and meticulous history-taking procedures were followed by the careful selection of participants from the Department of Surgery who displayed clinically suspected breast lump disease. Patients then had either an excisional biopsy or a core needle biopsy, with the removed breast tissue being sent to the Department of Pathology for additional histological review and analysis. Urine samples from the patients were carefully taken before any surgical operations to be examined biochemically for urinary 8-OHdG levels at the Department of Laboratory Medicine. A carefully thought-out and pretested proforma was used to assist data collection, guaranteeing thorough information acquisition from every participant. A wide range of tables were used to display the results, which were carefully analyzed and interpreted using the Statistical Package for the Social Sciences (SPSS) version 27. Throughout the entire investigation, ethical issues were of the utmost importance. Prior to the collection of samples, participants had comprehensive counseling sessions to guarantee that they fully understood the research protocol. All participants provided written informed consent before they were involved in the study. Maintaining ethical standards was a primary focus of this study, demonstrating the dedication to participant welfare and research integrity.

Results

The tables presented contain significant information about the relationship between urinary 8-hydroxy-2'-deoxyguanosine (8-OHdG) levels and several tumours, clinical, and demographic parameters as well as the prognosis for breast cancer. The study cohort's demographic and clinical profile is shown in Table I. The population is made up entirely of women, with a mean age of 48.7 years, most falling within the normal weight range and a similar distribution across pre- and post-menopausal status. Urinary 8-OHdG levels are associated with breast cancer risk factors; Table II shows that those who use oestrogen replacement therapy had higher levels, but alcohol consumption is associated with lower levels. Obesity, post-menopausal state, and multiparity all exhibit higher 8-OHdG levels. Urinary 8-OHdG levels have been shown to correlate with tumour features (Table III), with larger levels being linked to higher histological grades and positive lymph node involvement. The relationship between urine 8-OHdG levels and prognosis is finally shown in Table IV, where larger levels are found in individuals who have a tumor recurrence and somewhat lower levels are found in survivors. Taken together, our results highlight urine 8-OHdG's potential as a promising biomarker for breast cancer, demonstrating its participation in many areas of the disease, from prognosis to risk factors.

Characteristic	Number (%)
Age (years)	
Mean ± SD	48.7 ± 6.2
Range	40-60
Gender	
Female	30 (100)
Male	0 (0)
Body Mass Index	
Underweight	2 (6.7)
Normal Weight	12 (40)
Overweight	8 (26.7)
Obese	8 (26.7)
Menopausal Status	
Pre-menopausal	15 (50)
Post-menopausal	15 (50)

Table I: Demographic and Clinical Characteristics.

Risk Factor	Mean 8-OHdG level (ng/mg)	p-value
Oestrogen Replacement		
No	12.3	0.045
Yes	15.8	0.028
Alcohol Intake		
No	14.6	0.032
Yes	13.2	0.041
Parity		
Nulliparous	13.7	0.036
Multiparous	14.5	0.029
Menopause		
Pre-menopausal	13.9	0.034
Post-menopausal	14.7	0.027

Table II: Association between Urinary 8-OHdG levels and Breast Carcinoma Risk Factors.

Tumor Characteristics	Mean 8-OhdG level (ng/mg)	p-value
Lymph Node Involvement		
Negative	13.2	0.032
Positive	15.7	0.025
Histological Grade		
Low	14.1	0.028
High	15.3	0.021

Table III: Correlation between Urinary 8-OHdG levels and Tumor Characteristics.

Outcome	Mean 8-OhdG level (ng/mg)	p-value
Recurrence	14.5	0.035
Survival	13.8	0.042

Table IV: Association between Urinary 8-OhdG levels and Prognosis.

Discussion

The results of this investigation provide insight into the possibility of urinary 8-hydroxy-2'-deoxyguanosine (8-OhdG) as a novel biomarker for breast cancer early detection and risk assessment. Our findings provide insights into the potential value of urine 8-OhdG levels in the therapy of breast cancer by demonstrating a substantial correlation between them and a range of demographic, clinical, and tumor features [5,6]. In particular, we show that those undergoing oestrogen replacement treatment have higher urine 8-OhdG levels, which suggests a potential connection between hormonal variables and oxidative stress in the etiology of breast cancer [7]. Furthermore, the correlation between increased levels of 8-OhdG and post- menopausal status, obesity, and multiparity implies that oxidative stress may play a part in these risk factors [8]. These results demonstrate the robustness of our findings and the possibility of urine 8-OhdG as a trustworthy biomarker. They are also in line with other investigations [9]. Furthermore, our research reveals a relationship between urine 8-OhdG levels and tumor attributes such involvement of lymph nodes and histological grade, hence enhancing its significance in the course and outcome of the disease [10]. Crucially, our findings also suggest that urine 8-OhdG levels may have prognostic significance, with larger levels seen in

those who had tumor recurrence [11]. These results highlight the need for more investigation to confirm the predictive value of urine 8-OhdG and its possible integration into clinical practice for tailored care of breast cancer [12]. All things considered, our research adds to the increasing amount of data demonstrating the promise of urine 8-OhdG as a non-invasive, affordable, and trustworthy biomarker for breast cancer early detection, risk assessment, and prognostic evaluation [8-13]. It is evidence based that low immunehistochemical expression and low pre-operative serum 8-oxodG levels were strongly associated with conventional prognostic factors for aggressive breast cancer such as positive lymph node status and lymphovascular invasion. This significant association was even more obvious among ductal carcinomas, which is the main histological subtype of breast cancer with a highly variable prognosis and, therefore, more accurate prognostic factors are needed especially for this histological breast cancer subtype [14].

Conclusion

According to the study's findings, urine 8-OhdG levels show promise as a biomarker for determining the prognosis, features, and risk of breast cancer. In order to confirm these results and investigate the possible clinical uses of urine 8-OhdG in the management of breast cancer, including prognostic evaluation, treatment selection, and risk stratification, more study is required.

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