# Clinical Significance of Urinary Polyamines as Novel Tumor Markers in Breast Cancer

**Thesis**
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# List of Abbreviations

| | |
|---|---|
| AJCC | American Joint Committee on Cancer |
| AMD | *S*-adenosylmethionine decarboxylase |
| APC | Adenomatous polyposis coli |
| ATM | Ataxia telangectasia mutated |
| AUC | Area under the curve |
| AZ | Antizyme |
| AZI | Antizyme inhibitor |
| CA | Cancer antigen |
| cdks | Cyclin dependent kinases |
| CBC | Complete blood count |
| CE | Capillary electrophoresis |
| CEA | Carcinoembryonic antigen |
| CSF | Cerebrospinal fluid |
| dcSAM | Decarboxylated *S*- adenosylmethionine |
| DAX | Diamine exporter |
| DCIS | Ductal carcinoma in situ |
| DFMO | Difluoromethylornithine |
| DiAcSpm | *N*1, *N*12 diacetylspermine |
| Dns-Cl | Dansyl chloride |
| $E_2$ | Estradiol |
| ECLIA | Electrochemiluminescence immunoassay |
| ELISA | Enzyme linked immunosorbent assay |
| Em | Electrochemical gradient across the plasma membrane |
| ER | Estrogen receptor |
| ESR | Erythrocyte sedimentation rate |
| FISH | Fluorescent in situ hybridization |
| FN | False negative |
| FNA | Fine-needle aspiration |
| FNAC | Fine needle aspiration cytology |
| FP | False positive |
| GC | Gas chromatography |

| | |
|---|---|
| HCC | Hepatocellular carcinoma |
| HPLC | High performance liquid chromatography |
| HPTP | High-performance thin-layer plates |
| HRT | Hormone replacement therapy |
| IHC | Immunohistochemistry |
| IQR | Interquartile range |
| Kv | Voltage gated $K^+$ channels |
| LCIS | Lobular carcinoma in situ |
| MAb | Monoclonal Antibody |
| MAT | methionine adenosyltransferase |
| MRI | Magnetic resonance imaging |
| NPV | Negative predictive value |
| ODC | Ornithine decarboxylase |
| PAI-1 | Urokinase plasminogen activator inhibitor 1 |
| PAI-2 | Urokinase plasminogen activator inhibitor 2 |
| PAO | Polyamine oxidase |
| PC | Paper chromatography |
| PCR | Polymerase chain reaction |
| PIVKA-II | Protein induced by vitamin K absence/antagonist II |
| PPV | Positive predictive value |
| PRs | Progesterone receptors |
| PTEN | Phosphatase and tensin |
| RIA | Radioimmunoassay |
| ROC | Reciever operating characteristic |
| SAM | *S*- adenosylmethionine |
| SBR | Scarff-Bloom-Richardson |
| SD | Standard deviation |
| SMO | Spermine oxidase |
| SMS | Spermine synthase |
| SRM | Spermidine synthase |
| SSAT | Spermidine/spermine *N*1-acetyltransferase |
| TLC | Thin layer chromatography |
| TN | True negative |

| | |
|---|---|
| TNM | Tumor-node-metastasis |
| TP | True positive |
| tRNA | Transfer ribonucleic acid |
| uPA | Urokinase plasminogen activator |
| uPAR | Urokinase plasminogen activator membrane bound receptor |

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# Introduction

In Egypt, breast cancer is regarded as the most common malignancy in women, accounting for 31% of all female cancers, and responsible for 15% of female cancer deaths ***(El Gezeery et al., 2008).***

Diagnosis of breast cancer is usually based on a combination known as triple diagnosis which includes physical examination of the breast and its draining lymph nodes, mammography or ultrasonography and fine needle aspiration cytology ***(Donegan, 2002a).*** Moreover, several tumor markers such as carcinoembryonic antigen (CEA), CA 15-3, tissue polypeptide antigen and HER- 2 have been implicated, as non-invasive useful clinical adjuncts in diagnosis and determining prognosis of breast cancer. However, it is generally agreed that the lack of diagnostic sensitivity and specificity of these tumor markers precludes their use in breast cancer (***Duffy, 2006).***

Polyamines such as putrescine, spermidine and spermine are naturally occurring organic cations that are found in plants, animals and microbes. They are formed by the enzymatic decarboxylation of the amino acids ornithine or arginine. They are essential for normal cell and tissue functions, including normal growth, development and tissue repair ***(Gerner and Meyskens, 2004).***

Polyamines have generated much interest in the last few years because elevated levels of these compounds in human tissue and biological fluids have been found in various types of cancer such as hepatocellular, prostatic and gastric carcinoma. Moreover several studies have established that the urinary polyamine levels in cancer reflect the severity and clinical