Journal of Biological Engineering Research and Review, 2017; 4(2): 18-22
ISSN: 2349-3232 Online
DOI: 10.5281/zenodo.15341742

Research Article

Biochemical Profile of Breast Cancer Patients Attended the Out-Patient Department of Cancer Unit, Mandalay General Hospital, Myanmar

Kyae Mhon Htwe[1], Thet Oo Wai[2], Saw Ohmnmar Khin[2], Thandar Myint Thaw[2], Tin Moe Win[3], Yi Yi Myint[4]

[1]*Quality Assurance Division, Department of Medical Research, Myanmar*

[2]*Biochemistry Research Division, Department of Medical Research (Pyin Oo Lwin Branch), Myanmar*

[3]*Oncology Unit, Mandalay General Hospital, Myanmar*

[4]*Department of Traditional Medicine, Myanmar*

kyaehmon.htwe.dr@gmail.com

ARTICLE INFO:

Article History:
Received: 28/12/2017
Revised: 17/02/2018
Accepted: 18/02/2018
Available Online: 24/02/2018

Keywords:
Breast Cancer, Chemotherapy, Biochemical profile, Myanmar, Biomarkers

Abstract: This experimental study was conducted to assess the biochemical profile including glucose, hepatic enzymes, renal biomarkers, uric acid and zinc levels of 36 newly-diagnosed cases of female breast cancer patients from the Out-Patient Department of Cancer Unit in Mandalay General Hospital, Myanmar. The parameters of breast cancer patients before the first cycle of chemotherapy were compared with those after the third cycle of chemotherapy; and also compared with those of apparently healthy controls. The baseline GPT and creatinine levels of patients were significantly higher, whereas urea and uric acid levels of patients were significantly lower than those of control subjects. Baseline uric acid and zinc levels of patients were significantly higher than those determined after the third cycle of chemotherapy. Therefore, these biochemical parameters may be useful in the treatment of breast cancer patients. Moreover, the patients should be carefully monitored during the course of treatment if they are treated with chemotherapeutic drugs that affect their biochemical profiles.

Citation: Htwe KM, Wai TO, Khin SO, Thaw TM, Win TM, Myint YY. Biochemical Profile of Breast Cancer Patients Attended the Out-Patient Department of Cancer Unit, Mandalay General Hospital, Myanmar. Journal of Biological Engineering Research and Review. 2017, 4(2), 18-22.

INTRODUCTION

The biochemical changes in carcinogenesis is mandatory to understand accurately. Determination of enzymes activities and analysis of concentrations of various cellular components can be useful in the treatment of cancers [1]. The two main categories of investigations in cancer biochemistry- cancer cell metabolism and how the cancer can affect the host cell metabolism [2]. Quantitatively, the biochemical distortions may be detected at two levels. At first, similar molecules are found in both normal cells and cancer cells, but with different quantities. Then, molecular constituents existing in normal cells are depleted in the cancer cells. The biochemical changes in the cancer cell may be in a serious condition, which result in a total deletion of an important molecule, leading to an error in metabolism [3]. Research findings concerning the typical bioenergetics and biosynthetic pathways in tumors show changes in metabolic regulation, for instance, increase in anaerobic glycolysis, the earliest biochemical pathway that successfully detected in cancer cells [4].

Chemotherapy and radiotherapy generally destruct the cancerous cells in the tissues. Normal cells are sometimes destroyed by these treatments [5]. Chemotherapy represents blocking or reversing the process of carcinogenesis by using chemotherapeutic agents. Clinical and experimental researches have revealed that various chemotherapeutic drugs have cytotoxicity which is mainly mediated by the formation of free radicals. Reactive oxygen species play a mandatory role in the pathogenesis of different diseases and cancers, affecting different organs like stomach, colon, ovaries and breast [6]. Biochemical tests are determined to measure the levels of enzymes, reactive oxygen species, chemicals and organic waste products found in body fluids. These tests can find out the functions of a variety of organs whether these organs work properly during chemotherapy or not. For an instance, liver function tests can detect the extent of liver damage due to chemotherapy. Abnormal findings of biochemical profile can detect the possible drawbacks of chemotherapy and the progression of the cancer [7].

Thus, the investigation of biochemical profile of cancer patients is necessary to determine the effect of cancer and its treatment on the metabolism of cancer patients. Furthermore, the results of biochemical parameters may be useful for further management like radiotherapy or chemotherapy [8].

In Myanmar, breast cancer (Ca breast) is one of the commonest female cancers and is annually increasing during these years [9]. Therefore, the present study was aimed to identify the biochemical profile of breast cancer patients attended the Out-Patient Department of cancer unit in Mandalay General Hospital, Myanmar. Firstly, biochemical parameters of breast cancer patients before the first cycle and after the third cycle of chemotherapy, and control subjects were determined. Then, these parameters in breast cancer patients before the first cycle were compared with those determined after the third cycle of chemotherapy, and also compared them with those of controls.

MATERIALS AND METHODS

This experimental study was conducted on two groups. One group comprised thirty-six in number of female breast cancer patients from Out Patient Department of Oncology Unit, Mandalay General Hospital, Myanmar.

Another group served as the control group comprising thirty-six in number of apparently healthy age-matched female subjects. Participants above twenty years of age were included in this study. Breast cancer patients, newly diagnosed cases proved by biopsy, and did not suffer from any major illness were included.

Table 1. Biochemical parameters in Ca breast patients before first cycle of chemotherapy and normal subjects

Variables	Ca Breast Patients Before Chemotherapy(n=36)	Normal Subjects (n=36)	*p* value
Glucose (mg/dL)	124.5 ± 26.4	135.0 ± 19.4	0.06
GOT (IU/L) (glutamate oxaloacetate transaminase)	38.1 ± 34.4	29.0 ± 7.1	0.13
GPT (IU/L) (glutamate pyruvate transaminase)	32.9 ± 30.3	20.6 ± 6.5	**0.02**
ALP (IU/L) (Alkaline phosphatase)	167.6±86.5	151.5±47.2	0.33
Total bilirubin (µmol/L)	4.5±1.5	4.5±1.6	0.98
Urea (mg/dL)	29.6 ± 8.7	36.1±10.7	**0.006**
Creatinine (mg/dL)	0.7±0.1	0.6±0.1	**0.003**
Uric acid (mg/dL)	4.6±1.2	5.4±0.9	**0.002**
Zinc (µg/dL)	100.9±63.2	88.5±27.4	0.29

Table 2. Biochemical parameters in Ca breast patients before the first cycle of chemotherapy and after the third cycle of chemotherapy

Variables	Ca Breast Patients Before Chemotherapy(n=36)	Ca Breast Patients After Third Cycle of Chemotherapy (n=36)	*p* value
Glucose (mg/dL)	124.5 ± 26.4	127.6 ± 63.9	0.72
GOT (IU/L)	38.1 ± 34.4	42.6 ± 26.9	0.49
GPT (IU/L)	32.9 ± 30.3	37.9 ± 24.8	0.40
ALP (IU/L)	167.6 ± 86.5	150.0 ± 56.2	0.22
Total bilirubin (µmol/L)	4.5 ± 1.5	11.9 ± 34.4	0.20
Urea (mg/dL)	29.6 ± 8.7	26.3 ± 11.1	0.14
Creatinine (mg/dL)	0.7 ± 0.1	0.7 ± 0.2	0.17
Uric acid (mg/dL)	4.6 ± 1.2	3.9 ± 1.5	**0.02**
Zinc (µg/dL)	100.9 ± 63.2	76.7 ± 20.6	**0.03**

Female breast cancer patients with metastasis and/or with other diseases like diabetes mellitus, cardiovascular diseases, hypertension, tuberculosis, hepatitis and HIV infections were excluded. Moreover, participants who were taking drugs for diseases and with pregnancy were also excluded.

Study Period

The data were collected within the period of September, 2014 to April, 2015.

Sample Size

It was assumed that the risk factor of biomedical profile of cancer patients to be as common as 70 % among cases and 35 % among controls with the power of 80 % and 95 % confidence, the required sample size was calculated as 74. Among them, one from cases and one from controls were removed in data analysis due to incomplete data.

Data collection and determination

Six milliliters of venous blood samples were taken after explaining the purpose, risks and benefits of the research and

after getting informed consents from the participants. Data were collected two times from the breast cancer patients before the start of chemotherapy and at the end of third cycle of chemotherapy. Data were also collected from the normal control subjects.

Serum zinc level was investigated by using atomic absorption spectrophotometer by the method of Parker [10]. Other biochemical parameters were determined by using biochemical analyzer at DMR (Pyin Oo Lwin Branch), Myanmar.

Data analysis

Data analysis was done by using SPSS software 20.0 version and results were reported as mean ± SD. Their p values were obtained by applying 't' test (paired and unpaired) and $p<0.05$ was considered as significant.

Ethical Consideration

This research was permitted by Ethic Review Committee on Medical Research involving Human Subjects, DMR (POL Branch), Myanmar.

RESULTS

A total of 100 female breast cancer patients from the Out-Patient Department of Oncology Unit, Mandalay General Hospital, Myanmar and fifty- two numbers of apparently healthy controls were enrolled as participants in this study. Among these patients, 64 numbers had withdrawn before blood collection after the third cycle of chemotherapy. Therefore, total serum samples of thirty-six numbers of patients, and those of normal control subjects were used for data analysis.

Firstly, biochemical parameters of breast cancer patients before the start of chemotherapy and control subjects were compared. The association of biochemical parameters in Ca breast patients before the start of chemotherapy and control subjects is detailed in Table 1.

Then, biochemical parameters in breast cancer patients before the start of chemotherapy and after the third cycle of chemotherapy were compared. The association of biochemical parameters in Ca breast patients before the first cycle of chemotherapy and after the third cycle of chemotherapy is detailed in Table 2.

DISCUSSION

Breast cancer is the commonest cancer among females worldwide. The incidence of breast cancer is increasing and so it is necessary to understand its pathogenesis, treatment response, nutrition and biochemical changes of patients [11]. In this study, comparing mean random blood glucose level in breast cancer patients before chemotherapy with apparently healthy controls, it was found that the result of controls is higher than that of patients but not significant. Similarly, that in breast cancer patients before chemotherapy was slightly lowered comparing with that measured after the third cycle of chemotherapy and it was also not significant. These findings were coincided with the finding of Mady and Al-Shihry [12]. They explained the fact that various cancers have accelerated glycolysis, regardless of their oxygen supply [12].

Serum levels of GOT and GPT are used commonly as parameters of hepatic damage as intracellular enzymes are released into blood after hepatic injury [13]. In this study, comparisons between mean serum GOT levels were not significant. However, serum GPT levels of baseline level of breast cancer patients were significantly higher than that of controls ($p < 0.02$). Serum GPT levels determined after the third cycle of chemotherapy was higher than that determined before the first cycle of chemotherapy but it was not significant. Significant rise in serum levels of GOT and GPT ($p<0.05$) in breast cancer patients after chemotherapy was observed in some studies [13]. One study explained that the significant elevation in liver transaminases may be due to increase in the rate of gluconeogenesis. These results may indicate that some hepatocellular damage is found in breast cancer patients and the impact of chemotherapy may increase the extent of hepatic injury [13, 14].

ALP is a sensitive predictor of mild biliary obstruction as well as progression of hepatocellular damage [13]. Evidence has shown that ALP was abnormal in a high percentage of breast cancer patients having secondary metastasis to bone and/or liver [15]. In this study, mean serum ALP level in patients before the first cycle of chemotherapy was higher than those of control group which was also higher than that of patients after the third cycle of chemotherapy but these results were not significant. These results were consistent with findings of Mohamad and his colleagues [16]. They suggested that these findings denote the feature of diminishing bone resorption after chemotherapy [16]. In this study, bilirubin concentration in breast cancer patients was not significantly different compared with that of the normal subjects. While, that in breast cancer patients after the third cycle of chemotherapy was higher, but not significantly different from baseline data measured before chemotherapy. The finding of Nwozo and co-workers agrees with the present study. Total bilirubin concentration indicates the capacity of liver having transport function and potent antioxidant activity [11].

Concerning with renal function tests, serum urea level in cases was significantly lower than that of control group ($p< 0.006$) whilst serum creatinine levels in patients was significantly higher than that of controls($p< 0.003$) in this study. However, all the results are within normal limits (urea 10- 50 mg/dL and creatinine 0.5-0.9mg/dL). In this study, mean serum urea and creatinine levels in patients before the first cycle of chemotherapy were not significantly different with those of patients after the third cycle of chemotherapy. It is accordance with the findings of Noviyani et al. from Indonesia [17]. They observed that there is no significant difference between serum creatinine and urea levels in cancer patients before chemotherapy and after the third cycle of chemotherapy. They suggested that it is necessary to have larger sample size to obtain significant statistics. In contrast, in the study of Rasheed and Iqtidar, they found that some treatments of cancer can harm the kidneys resulting in the kidney damage. Damaging kidneys can be reversible, if the life-threatening complications are controlled carefully [18]. Therefore, it is very important to assess the renal function tests before and during chemotherapy although the results are controversial [18].

The risk of cancer incidence can be reduced by antioxidants because antioxidants may help the body's defense mechanism and combat free radicals that can be a cause of cancer development [19]. Antioxidants may also reduce the risk of breast cancer [19]. Uric acid which is the final product of purine nucleotide metabolism is considered as a crucial antioxidant found in the plasma [20]. In this study, breast cancer patients had significant lower mean serum uric acid concentration than normal subjects. Moreover, mean serum uric acid level that determined after the third cycle of chemotherapy of breast cancer patients was significantly lower than that measured as the baseline level in breast cancer patients ($p< 0.02$). In the study of Abdel-Salam et al, significant decrease in uric acid level has been seen in breast cancer patients after chemotherapy; and uric acid levels were lower in cancer with metastasis than that of cancer patients with no metastasis [20].

In this study, the mean serum zinc level of breast cancer patients was lower than that of control subjects. Furthermore, mean serum zinc baseline level of breast cancer patients was significantly lower than that determined after third cycle of chemotherapy ($p< 0.02$). This result came in accordance to those reported by Hassanein et al., Yucel et al. and Gaber who found that the mean serum zinc level in patients with breast cancer was significantly decreased than control subjects, and on chemotherapy, the values are in addition lower than that determined before chemotherapy. This decrease may be due to the role of zinc as a potent antioxidant activity and as a cellular growth protector [21, 22, 23].

The main findings of this study included that the baseline GPT and creatinine levels of patients were significantly higher, whereas urea and uric acid levels of patients were significantly lower than those of normal subjects. Baseline uric acid and zinc levels of breast cancer patients were significantly higher than those determined after the third cycle of chemotherapy. These findings indicated that some associations of biochemical parameters between breast cancer patients and normal patients, as well as, biochemical parameters that determined in same breast cancer patients before chemotherapy and after the third cycle of chemotherapy were significant but not in all parameters. This may be due to small sample size in the present study.

In addition, this may be due to rehydration, and rebuilt management during chemotherapy as supportive treatments. Moreover, it may be because the comparison of biochemical parameters in breast cancer patients was examined between the baseline and only at the end of the third cycle of chemotherapy. Although this study had some limitations, these measurements of biochemical parameters may be useful in the treatment of breast cancer patients.

It is recommended that biochemical parameters should be done before each cycle of chemotherapy for detecting the side effects of chemotherapy and monitoring the cancer progression. Moreover, further studies are necessary to find out the comparison of biochemical parameters in breast cancer patients between the baseline and after the six cycle of chemotherapy. Furthermore, it is needed to carry out the studies regarding the determination of biochemical profiles in other cancers.

CONCLUSION

In the present study, some biochemical parameters were different between control and before chemotherapy, and between before and after chemotherapy. However, they all were within normal values. This may be due to rehydration, and rebuilt management during chemotherapy. Therefore, effective supportive treatments are important in management of breast cancer with monitoring the levels of biochemical parameters before and during chemotherapy. Therefore, the determination of biochemical parameters may be useful in the treatment of breast cancer patients. Moreover, the patients should be carefully monitored during the course of treatment if they are treated with chemotherapeutic drugs that affect their biochemical profiles.

ACKNOWLEDGEMENT

I would like to express my grateful thanks to Dr. Kyaw Zin Thant, Director General, DMR and Dr. Win Aung, Deputy Director General, DMR (POL Branch) for their thoughtful help and encouragement. I must also express my profound thanks to Dr. Phyu Phyu Thin Zaw, Research Officer, Epidemiology Research Division, DMR (POL Branch) for her help and suggestions. Finally, I must not fail to mention my sincere thanks to all participants who gave their written informed consent to participate in this study.

Conflict of Interest: There are no competing interests in this manuscript.

Authors' Contributions: Kyae Mhon Htwe and Thet Oo Wai developed the proposal of this research, chose the study design, performed the systematic literature search, and analyzed the data, prepared and writing the manuscript. All authors participated from planning to write the manuscript.

REFERENCES

1. Smets LA, Van Beek WP. Carbohydrates of the tumor cell surface. Biochimica et Biophysica Acta, 1984; 738: 237-249.
2. Greenstein J P. Biochemistry of cancer. 2nd edition. New York. Academic press, 1944.
3. Hammond KD & Balinsky D. Activities of key gluconeogenic enzymes and glycogen synthesis in rat and human liver, Hepatomas, and Hepatoma Cell Cultures. Cancer Research, 1978; 38(5): 1317-1322.
4. Weber G. Enzymology of cancer cells. The New England Journal of Medicine, 1977; 296 (9): 486 - 493.
5. Akinbami A, Popoola A, Adediran A, Dosunmu A, Oshinaike O, Adebola P et al., Full blood count pattern of pre-chemotherapy breast cancer. Caspian Journal of Internal Medicine, 2013; 4(1):574-579.
6. Moradi M, Eftekhari MH, & Talei A. Plasma Selenium Concentration and Glutathione Peroxidase Activity in Breast Cancer Patients before and After Chemotherapy. Iranian Journal of Cancer Prevention, 2008; 1(3): 119-122.
7. Brown JE, Cook RJ, Lipton A, Coleman RE. Serum lactate dehydrogenase is prognostic for survival in patients

with bone metastases from breast cancer: a retrospective analysis in bisphosphonate-treated patients. Clinical Cancer Researrch, 2012; 18:6348-6355.
8. Abidi S, & Ali A. Role of oxygen free radicals in the pathogenesis and aetiology of cancer. Cancer Letters.1999; 142:1-9.
9. World Health Organisation. Cancer country profiles, 2014. WHO, Geneva, viewed 4 February 2018 < http://www.who.int/cancer/country-profiles/en/>
10. Parker MM, Humoller FL & Mahler DJ. Determination of Copper and Zinc in Biological Material. Clinical Chemistry.1967; 13: 40.
11. Nwozo SO, Solomon, O, Abimbola, OO, & Kikelomo DO. Comparative Study of Biochemical and Nutritional Status of Breast Cancer Patients on Chemotherapy /Radiotherapy in Ibadan. American Journals of Cancer Science, 2013; 2(1):23-32.
12. Mady EA & Al-Shihry SS. A comparative biochemical profile of cancer and normal cell in vivo. Available from www.kfu.edu.sa/ar/Deans/Research/.../1059.pdf [20.9.2014]
13. Kind PR, Gordon M, Laverich M, & Slavin BM. The effect of C3H mouse mammary tumor on the levels of serum and urine analyses in vivo. British Journal of Cancer, 1985; 52: 607- 611.
14. Liu CL, Huang JK, Cheng SP, Chang YC, Lee JJ, & Liu TP. Fatty liver and transaminase changes with adjuvant tamoxifen therapy. Anticancer Drugs 2006; 17:709-713.
15. Keshaviah A, Dellapasqua S, Rotmensz N, Lindtner J, Crivellari D, Collins J, Colleoni M, & Thürlimann B. CA15-3 and alkaline phosphatase as predictors for breast cancer recurrence: a combined analysis of seven International Breast Cancer Study Group trials. Annals of Oncology, 2007; 18 (4): 701-708.
16. Mohamed EI, Abdel-Mageed SM, Khalil GI, Emara AA, Ramadan HS & Abdel-Moneim NA. Effect of adjuvant chemotherapy on carboxytelopeptide of cross-linked type I collagen of Egyptian women with non-metastatic breast cancer. Herbert Open Access Journals, Breast Cancer Reports 2014. Available from http://www.hoajonline. com/ journals/ pdf/ 2057-1631-1-1-pdf [18.5.2015]
17. Noviyani R, Indrayathi PA, Thabrany H, Andrijono, & Budiana NG. Differences in the value of blood urea nitrogen and creatinine serum in cervical cancer squamous cell stadium IIB-IIIB before and after chemotherapy paclitaxel cisplatin for six cycles in Sanglah General Hospital Denpasar, Bali, Asian Journal of Pharmaceutical and Clinical Research, 2017; 10 (2): 381-384.
18. Rasheed A, Iqtidar A. Biochemical profile in liver cancer patients. Acta Pharmacologica Sinica 1995; 16 (4): 366-367.
19. Smith-Warne SA, Spiegelman D, Adami HO, Beeson WL, et al. Types of dietary fat and breast cancer: a pooled analysis of cohort studies. International Journal of Cancer. 2001, 92:767-774.
20. Abdel-Salam OME, Youness ER, & Hafez HF. The antioxidant status of the plasma in patients with breast cancer undergoing chemotherapy. Open Journal of Molecular and Integrative Physiology, 2011; 1: 29-35.
21. Hassanein MRR, Mahfouz MKM, Abou-Zied OAR, Mostafa RMA, & Mohamed RRG. Biochemical study on the activities of glutathione peroxidase, superoxide dismutase and catalase in women breast cancer. First Scientific Conference of Faculty of Veterinary Medicine; 2004: 92-107.
22. Gaber MH. Trace elements in breast cancer Cairo University. (EGY). Faculty of Medicine. The Medical Journal of Cairo University, 1993; 61(4): 1071 – 1075.
23. Yücel I, Arpaci F, Ozet A, Döner B, Karayilanoğlu T, Sayar A, & Berk O. Serum copper and zinc levels and copper / Zinc ratio in patients with breast cancer. Biological Trace Element Research, 1994; 40 :1, 31 – 38.

About Author

Dr. Kyae Mhon Htwe is working as Deputy Director, Quality Assurance Division, Department of Medical Research, Myanmar. She received M.B.B.S in 2001 and M. Med. Sc. (Biochemistry) in 2008 from University of Medicine, Mandalay, Myanmar. She has also received M.P.H (Nutrition), Flinders University, Australia in 2017. She has published several research papers in the journal of repute.