

The Impact of Bacterial Infection on Renal and Metabolic Biochemical Parameters in Thyroid Cancer Patients

Anwar M. Lazm^{1*} and Alaa Saadi Abboud²

¹ Department of Optics Techniques, College of Health and Medical Techniques, Middle Technical University, Baghdad, Iraq
² Iraqi Center for Cancer and Medical Genetic Research, Mustansiriyah University, Baghdad, Iraq

Article Info	ABSTRACT
<p>Article history:</p> <p>Received April, 07, 2025 Revised May, 19, 2025 Accepted June, 25, 2025</p> <hr/> <p>Keywords:</p> <p>Serum Urea, Serum Creatinine, Fasting Blood Sugar, Bacterial Infection, Thyroid Cancer.</p>	<p>This study examines the biochemical changes—specifically, serum urea, creatinine, and fasting blood sugar levels—in thyroid cancer patients who have contracted bacterial infections. We observed substantial increases in serum urea ($p = 0.03$), creatinine ($p = 0.02$), and fasting blood sugar ($p < 0.001$) in infected patients using a case-control design that included 50 thyroid cancer patients and 50 healthy controls. These results suggest that bacterial infections are associated with a risk of renal and metabolic dysfunction. Nevertheless, there were no substantial alterations in liver function indicators. The significance of monitoring renal and metabolic health in thyroid cancer patients with concurrent bacterial infections is underscored by these findings.</p>
<hr/> <p>*Corresponding Author:</p> <p>* Anwar M. Lazm Department of Optics Techniques, College of Health and Medical Techniques, Middle Technical, University, Baghdad -Iraq Email: Anwar-mohammed@mtu.edu.iq</p> <hr/>	

1- INTRODUCTION

Thyroid cancer is a common endocrine malignancy affected by genetic, environmental, and infectious risk factors. Recent evidence indicates that concurrent bacterial infections may aggravate biochemical abnormalities in these patients [1]. Specifically, changes in serum urea and creatinine concentrations may indicate renal stress or impairment, whereas increased fasting blood glucose levels imply metabolic stress [2]. Cancer of the thyroid is the most prominent endocrine malignancy, and its incidence is increasing worldwide, the management of thyroid cancer can be complicated by systemic alterations, including hormonal imbalance, metabolic stress, and impaired immune surveillance, despite the fact that it is generally associated with a favorable prognosis [3]. These factors may increase the likelihood of opportunistic bacterial infections in patients, particularly during or after treatments such as surgery, radioiodine therapy, or chemotherapy [4].

Bacterial infections in cancer patients are clinically significant due to their ability to exacerbate pre-existing physiological stress, disrupt therapeutic regimens, and contribute to morbidity. Systemic inflammation and sepsis can be precipitated by infections, which can result in organ dysfunction, particularly renal impairment and metabolic dysregulation [5]. The kidneys are particularly vulnerable because they are essential for maintaining homeostasis through fluid balance, waste excretion, and electrolyte regulation [6]. Liver enzymes, glucose levels, and lipid profiles may all change in response to infection-induced metabolic changes, regarding these concerns; there is not a lot of data concerning the precise effects of bacterial infections on renal and metabolic biochemical parameters in patients with thyroid cancer [7]. Comprehending these modifications is crucial for the early identification of complications, directing supportive treatment, and enhancing overall clinical results [8]. This study examined how bacterial infections affect biochemical functions and markers in cancer patients to understand how infection, cancer, and general physiological functions interact. We show that high rates of infection affect health and metabolism,

including healthcare outcomes, by comparing biochemical markers in cancer and diabetes patients with bacterial and other infections.

2- MATERIAL AND METHOD

Participants and Study Design

Fifty thyroid cancer confirmed patients and fifty age- and sex-matched healthy controls made up the 100 participants in total. Between May 2024 and February 2025, the participants were gathered from [Al-Andalus Hospital, Al-Dawli Al-Ahli Hospital, and Al-Amal National Oncology Hospital].

Collection and Processing of Samples

Five millilitres of venous blood samples were obtained from each participant under sterile circumstances. The samples underwent centrifugation at 3000 rpm for 10 minutes, after which the serum was isolated and preserved at -20°C until analysis.

Analysis of Biochemistry

Using commercially available test kits and an automated biochemical analyzer (Roche cobas c111), the serum levels of creatinine and urea were determined. The glucose oxidase technique was also used to measure the levels of fasting blood sugar (FBS). To investigate possible hepatic involvement, liver function indicators such as aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were measured.

Microbiological Examination

Bacterial infections were detected using blood and urine cultures. Samples were inoculated onto MacConkey agar and blood agar plates and incubated at 37°C for 24 to 48 hours. Bacterial identification was conducted with conventional biochemical assays and Gram staining techniques. Antibiotic susceptibility testing was performed with the Kirby-Bauer disc diffusion technique.

Analysis of Statistics

SPSS software (GraphPad Prism 9 and SPSS 27) was used to analyse the data. Categorical data were displayed as frequencies and percentages, whereas continuous variables were represented as mean \pm standard deviation (SD). To compare the biochemical parameters between groups, independent t-tests and chi-square tests were employed. P-values less than 0.05 were regarded as statistically significant.

3- RESULTS AND DISCUSSION

Demographics and Bacterial Infections Table 1 shows no statistically significant differences in bacterial infection rates between thyroid cancer patients and controls. According to Table 2, thyroid cancer patients have a higher mean age ($p < 0.004$) and a higher family history of cancer ($p = 0.02$) compared to controls. No significant gender or smoking history differences were found.

Tables 1 and 2 reveal the relationship between bacterial infections and renal function and thyroid cancer patient demographics. The most common bacterial infections in the study population were *Staphylococcus aureus*, *Helicobacter pylori*, and *Pseudomonas aeruginosa* (Table 1). These infections were not statistically significant in this cohort (p-values between 0.269 and 0.674), but they suggest further research. This supports other studies showing diverse rates of specific bacterial infections in cancer patients. Based on post-treatment immunity [9] found a high rate of *Staphylococcus aureus* infections in oncology patients, surgical procedures that disrupt skin flora may increase thyroid cancer risk by promoting bacterial colonization [10]. *Helicobacter pylori* may be linked to thyroid cancer, but the evidence is mixed (Kansra et al., 2020) [11]. Table 2 shows significant demographic differences between thyroid cancer patients and controls, with a significantly higher mean age (53.70 ± 7.39 years vs. 46.00 ± 10.73 years, $p < 0.004$). This supports the literature linking thyroid cancer to older age [12]. Family history significantly affects thyroid cancer susceptibility, while smoking history does not. As research shows that many thyroid cancers are hereditary, genetic and hormonal factors are involved [13]. Our demographic profile shows that older thyroid cancer patients are more susceptible to infections that can harm renal function, highlighting the need for targeted infection prevention and management strategies. These associations should be studied to determine how bacterial infections affect this population's health.

Table 1: Bacterial infections among Thyroid cancer patients

Bacterial infection	Thyroid cancer patients (50)	Control group (50)	P value
<i>Staphylococcus aureus</i>	6	2	0.269
<i>Helicobacter pylori</i>	7	4	0.523
<i>Pseudomonas aeruginosa</i>	2	0	N/A
<i>Escherichia coli</i>	4	2	0.674
Other bacterial infection	2	0	N/A

Table 2: demographics variables

Characteristics	Thyroid cancer patients (50)	Control group (50)	P value
Age mean	53.70±7.39	46.00±10.73	< 0.004
Gender			
Female	23	23	> 0.05
Male	27	27	
Smoking history	21	14	0.208
Family history of cancer	12	3	0.02

Serum urea and creatinine concentrations in thyroid cancer patients with positive and negative bacterial infections are shown in Table 3. People with positive bacterial infections have higher serum urea and creatinine levels than those with negative infections (P values of 0.03 and 0.02, respectively). Patients with positive bacterial infections have an average blood urea level of 26.5 ± 6.16 mg/dl, while those without infectious conditions have 21.7 ± 7.29 mg/dl. The statistically significant P value (0.03) suggests a strong link between bacterial illness and high blood urea. Infection-induced catabolism may increase urea concentrations [14]. Individuals with positive bacterial infections have significantly higher serum creatinine levels (1.85 ± 0.301 mg/dl) compared to those without (1.55 ± 0.299 mg/dl), with a P value of 0.02 [15] found that infections can damage the kidneys, raising creatinine levels.

Tables 3: relationship of bacterial infection and kidney function (urea and creatinine)in thyroid cancer patients

parameter	positive bacterial infection(21)	negative bacterial infection(29)	P value
Urea(mg/dl)	26.5±6.16	21.7±7.29	0.03
Creatinine(mg/dl)	1.85±0.301	1.55±0.299	0.02

In table 4, liver function markers show no significant differences in alkaline phosphatase and alanine aminotransferases between infected and non-infected thyroid cancer patients, suggesting that bacterial infections do not affect liver function in this group.

[16] Found that chronic infections often raise ALP levels due to bone turnover or biliary obstruction. This study's insignificant results suggest that acute bacterial infections may not affect thyroid cancer patients' ALP levels. Mean alanine aminotransferase levels are 139 ± 18.2 U/L for those with positive bacterial infections and 141 ± 15.6 U/L for those without, with a P value of 0.76, indicating no significant difference. Infections can raise ALT levels, according to Wong *et al.* (2019) [17]. In thyroid cancer patients, bacterial infections may not significantly impact hepatic function in the short term [18]. ALT elevations may indicate pre-existing liver function rather than acute infection.

Tables 4: a relationship of bacterial infection and liver function (Alkaline Phosphatase, Alanine Amino-transferase) among thyroid cancer

Parameter	Positive bacterial infection(21)	Negative bacterial infection(29)	P value
Alkaline Phosphatase U/L	52.7±15.2	58.7±15.4	0.21
Alanine Aminotransferase U/L	139±18.2	141±15.6	0.76

In table 5, patients with positive bacterial infections have a mean fasting blood sugar level of 209 ± 38.1 mg/dl, compared to 143 ± 21.0 mg/dl for those without bacterial infections. Bacterial infections are strongly linked to high fasting blood sugar ($P < 0.001$). Previous research supports these findings. Jing, L., and Zhang *et al.* (2022) found that stress and inflammatory mediators like cytokines can temporarily raise blood glucose levels during infections [19]. Fajardo *et al.* (2018) found that infectious processes increase glucose levels in cancer patients, likely due to altered metabolic processes during inflammation [20]. Bacterial infections increase fasting blood sugar due to insulin resistance and stress-induced gluconeogenesis. In cancer patients, stress hormones and inflammatory cytokines may disrupt insulin signaling, raising blood glucose levels [21].

Table 5: a relationship of bacterial infection and Fasting Blood Sugar mg/dL in thyroid cancer patients

parameter	positive bacterial infection(21)	negative bacterial infection(29)	P value
Fasting Blood Sugar mg/dL	209±38.1	143±21.0	< 0.001

5- CONCLUSION

This study demonstrates a strong correlation between renal function impairment and bacterial infections in individuals with thyroid cancer. A possible connection between infection and renal failure is suggested by elevated blood urea and creatinine levels in infected individuals. Moreover, elevated fasting blood sugar levels suggest metabolic abnormalities that might have additional negative effects on a patient's health. The results highlight how crucial it is to keep an eye on infections in thyroid cancer patients in order to prevent renal consequences, even if there was no discernible impact on liver function indicators. Clinical results and general patient well-being may be enhanced by the early identification and treatment of bacterial infections. To investigate the underlying processes and create focused treatment plans, further study is required.

REFERENCES

- [1] Santos, M. M., et al. (2021). Thyroid cancer and the complications of treatment: A focus on co-morbidities. *Journal of Endocrinological Investigation*, 44(5), 897–905. <https://doi.org/10.1007/s40618-020-01387-0>
- [2] Patel, R. A., & Ali, A. F. (2020). Bacterial infections and renal dysfunction in cancer patients: Mechanisms and management. *Clinical Oncology*, 32(7), 439–445.
- [3] Davis, R. B., & Thompson, S. H. (2020). Thyroid cancer: The role of infection in disease progression. *Thyroid Research*, 13(1), 12–17.
- [4] Kellum, J. A., et al. (2018). Acute kidney injury: Diagnostic approaches and controversies. *Clinical Chemistry*, 64(1), 29–38. <https://doi.org/10.1373/clinchem.2017.275644>
- [5] Johnson, L. J., & Smith, L. M. (2019). Thyroid cancer treatment and its impact on kidney function. *Endocrine Reviews*, 40(2), 123–134.
- [6] Zhang, Y. Q., & Wang, J. H. (2021). The impact of infections on renal function in cancer patients: A systematic review. *Journal of Nephrology & Therapeutics*, 11(3), 113–120.

- [7] Smith, J. T., & Lee, H. K. (2021). The relationship between bacterial infections and metabolic syndrome in cancer patients. *Cancer Metabolism*, 9(2), 105–112.
- [8] Meyer, K. C., et al. (2018). The role of *Staphylococcus aureus* in acute respiratory infections among cancer patients. *Journal of Infectious Diseases*, 217(2), 221–227. <https://doi.org/10.1093/infdis/jix534>
- [9] Mousa, H., & Zoori, A. (2023). The prevalence of thyroid disorders in Nasiriya City, Iraq: Thyroid disorders. *University of Thi-Qar Journal of Science*, 10(1).
- [10] Takahashi, S., Ito, M., Masaki, Y., Hada, M., Minakata, M., Kohsaka, K., et al. (2021). Association between serum thyroid hormone balance and thyroid volume in patients treated with levothyroxine monotherapy for hypothyroidism. *Endocrine Journal*, 68(3), 353–360.
- [11] Kansra, S., et al. (2020). *Helicobacter pylori* and thyroid disorders: A controversy. *Thyroid Research*, 13(1), 24–30.
- [12] Mazzaferri, E. L., & Jhiang, S. M. (2004). Long-term impact of initial surgical and medical therapy on thyroid cancer. *Thyroid*, 14(3), 204–213.
- [13] Haugen, B. R., et al. (2016). 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer. *Thyroid*, 26(1), 1–133. <https://doi.org/10.1089/thy.2015.0020>
- [14] Kogure, T., et al. (2020). The relationship between infection and renal function in cancer patients. *Journal of Infectious Diseases*.
- [15] Kerdpin, U., et al. (2019). Serum urea and creatinine as markers of renal function in cancer patients. *Cancer Research Journal*.
- [16] Raza, A., et al. (2021). Impact of infections on renal function in oncology patients: A review. *Nephrology Dialysis Transplantation*.
- [17] Wong, C. L., et al. (2019). Alanine aminotransferase levels and their clinical significance in bacterial infections. *Hepatology Research*.
- [18] Smith, R. J., et al. (2017). The impact of infections on liver function tests: A review. *Liver International*.
- [19] Jing, L., & Zhang, Q. (2022). Intrathyroidal feedforward and feedback network regulating thyroid hormone synthesis and secretion. *Frontiers in Endocrinology*, 13, 992883. <https://doi.org/10.3389/fendo.2022.992883>
- [20] Fajardo, M. E., et al. (2018). Impact of infections on glucose metabolism in cancer patients. *Endocrine Connections*.
- [21] Munoz, J., et al. (2020). The effect of stress on glucose metabolism in cancer patients. *Journal of Clinical Oncology*.

العلاقة بين العدوى البكتيرية وتركيزات اليوريا والكرياتينين في المصل لدى مرضى سرطان الغدة الدرقية

الخلاصة

تم في هذه الدراسة فحص التغيرات الكيميائية الحيوية، وتحديد مستويات اليوريا والكرياتينين في المصل وسكر الدم الصائم، لدى مرضى سرطان الغدة الدرقية المصابين بعدوى بكتيرية. وقد لاحظنا زيادات ملحوظة في اليوريا في المصل ($p = 0.03$)، والكرياتينين ($p = 0.02$)، وسكر الدم الصائم ($p < 0.001$) لدى المرضى المصابين، وذلك باستخدام تصميم دراسة الحالات والسيطرة الذي شمل ٥٠ مريضا بسرطان الغدة الدرقية و ٥٠ شخصا سليما. تشير هذه النتائج إلى أن العدوى البكتيرية ترتبط بخطر اختلال وظائف الكلى والأيض.

ومع ذلك، لم تلاحظ أي تغيرات جوهرية في مؤشرات وظائف الكبد. وتؤكد هذه النتائج أهمية مراقبة صحة الكلى والأيض لدى مرضى سرطان الغدة الدرقية المصابين بعدوى بكتيرية متزامنة.

