Judi Clinical Journal | 2025;1(2):89-98
Journal home page: https://judijournal.com

Original Article

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Clinicopathological Profile of Malignant Tumors at a Tertiary Center in Iraq: A Five-Year Analysis

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Received: *Aug 18, 2025* ***Revised:*** *Oct 07, 2025* ***Accepted:*** *Nov 08, 2025* ***First Published:*** *Nov 18, 2025*

Introduction: Cancer incidence and mortality are increasing worldwide, disproportionately affecting low- and middle-income countries due to limited healthcare access. This study aims to analyze the prevalence and clinicopathological characteristics of cancers diagnosed at a tertiary care center, offering crucial data to inform regional cancer control efforts.

Methods: This retrospective study was conducted at a single tertiary center, analyzing histopathological reports from January 2020 to January 2025. Data were collected from digital and physical archives by a trained team, including only confirmed malignant diagnoses. Variables extracted included patient demographics, cancer types, tumor characteristics, and procedure details. Data integrity was ensured through double-entry and expert review. Statistical analysis using SPSS 27.0 summarized categorical variables as frequencies, percentages and continuous variables as means or medians.

Results: A total of 9,375 cases were analyzed (median age 48 years), with females comprising 75.74% (7,101 cases). The age-standardized incidence rate was 82.20 per 100,000. Head and neck cancers accounted for 2,903 cases (30.97%), primarily thyroid (2,208 cases), followed by thoracic malignant tumors with 2,556 cases (27.26%). Invasive ductal carcinoma was most frequent cancer type (2,392 cases, 25.5%). Larger tumors correlated significantly with positive margins and lymph node involvement ($p < 0.05$).

Conclusion: The study highlights a unique cancer profile, with younger age at diagnosis and higher rates of head, neck, and thyroid cancers. These findings underscore the need for targeted screening and prevention strategies adapted to regional healthcare systems.

Keywords: Cancer epidemiology, Histopathology, Thyroid cancer, Breast cancer

How to cite this article: Kakamad FH, Abdalla BA, Hussein DA, Abdullah F, Mustafa AM, Hasan SJ et al. Clinicopathological Profile of Malignant Tumors at a Tertiary Center in Iraq: A Five-Year Analysis. Judi Clin. J. 2025;1(2):89-98. https://doi.org/10.70955/JCJ.2025.12

1. Introduction

Cancer remains one of the foremost causes of morbidity and mortality globally, representing a growing public health challenge of increasing magnitude and complexity. According to the International Agency for Research on Cancer, an estimated 20 million new cancer cases and 9.7 million cancer-related deaths were recorded worldwide in 2022 [1,2]. These figures underscore the profound global burden of cancer, with approximately one in five individuals developing the disease during their lifetime. Notably, one in nine men and one in twelve women are estimated to die from cancer [3].

Projections indicate that by 2070, the global incidence of cancer will surpass 34 million new cases annually, with lower-income countries experiencing a disproportionate impact marked by an anticipated 400% increase in cancer incidence over the next five decades [4]. Among the malignancies expected to contribute most significantly to this rise are breast, lung, and colorectal cancers. Current epidemiological models forecast that colorectal cancer cases will increase from 1.9 million in 2020 to 3.2 million by 2040, while breast cancer incidence is projected to reach a similar level by 2050, rising from 2.26 million cases in 2020 [5,6].

Substantial disparities in cancer burden are evident across countries with different income levels and health system capacities. In high-income nations, rising incidence rates of breast and thyroid cancers have been partially attributed to improved access to healthcare services and widespread implementation of early detection and screening programs [7]. Conversely, low- and middle-income countries tend to report higher incidence rates of cancers associated with infectious etiologies, such as cervical and liver cancers. These regions also face significantly higher cancer mortality rates, largely due to limited access to preventive services, early diagnosis, and effective treatment options [8,9]. Furthermore, marked differences

in mortality-to-incidence ratios are observed across human development index categories. Data from Globocan 2020 indicate that mortality-to-incidence ratios are nearly twice as high in low- human development index countries compared to very high- human development index countries, 0.75 versus 0.36 for men, and 0.69 versus 0.30 for women [10].

Given the magnitude of the global cancer burden and the critical role of accurate epidemiological data in informing cancer control strategies, institution-level studies are essential. The current study aims to evaluate the prevalence and clinicopathological characteristics of cancers diagnosed via histopathological examination at a tertiary care center. By analyzing cases over a five-year period, this study seeks to provide insights into the local cancer profile, and identify the most frequently diagnosed cancer types. All referenced data sources have been verified for eligibility [11].

2. Methods

2.1. Study Design and Setting

This retrospective study was conducted at Smart Health Tower, Iraq. All histopathological reports issued between January 2020 and January 2025, were considered for inclusion.

2.2. Data Collection

Data were retrieved from both the digital and physical archives of the pathology department. A team of more than ten trained individuals participated in the collection process to ensure completeness and accuracy. Only reports that provided complete documentation of the required parameters were included in the analysis.

2.3. Inclusion and Exclusion Criteria

All histopathological reports confirming a malignant diagnosis and issued within the specified time frame were included in the study. Reports were excluded if they lacked a definitive diagnosis of cancer, were incomplete, or were duplicates.

2.4. Variables and Data Extraction

The following variables were extracted from each eligible report: patient age at diagnosis, sex, nationality, anatomical location of the lesion, cancer type, definitive diagnostic approach (histology, cytology, or immunohistochemistry), resection margin status (free or involved), tumor size in millimeters, and lymph node involvement (present or absent). All variables were systematically documented in a structured database for analysis.

2.5. Data Quality and Management

To maintain data integrity, a double-entry process was implemented. Two independent researchers entered the data separately, and any discrepancies between entries were resolved by reviewing the original reports. Only de-identified data were used.

2.6. Ethical Considerations

As this study involved retrospective analysis of anonymized medical records, the requirement for informed consent was waived. Confidentiality and data protection standards were strictly followed throughout the study. Ethical approval was obtained from the Kscien Organization (Approval No. 41/2025).

2.7. Statistical Analysis

Data analysis was performed using SPSS (Statistical Package for the Social Sciences) software (version 27.0). Descriptive statistics were used to summarize the data. Categorical variables, such as sex, type of cancer, and the anatomical system or organ affected, were reported as frequencies and percentages. Continuous variables, including age and tumor size, were presented as means with standard deviations or medians with quartile ranges, depending on data distribution. Comparisons of tumor size between groups (e.g., free vs. positive resection margins, lymph node involvement vs. no involvement) were performed using the Mann–Whitney U test, as tumor size was not normally distributed. A p-value < 0.05 was considered statistically significant.

3. Results

A total of 9,375 patients were analyzed (median age: 48.0 years; QR: 39.0–60.0). The age-standardized incidence rate was 82.20 (411.01/5) per 100,000 population per year (Table 1). Cancer incidence per 100,000 population rose with age, from 10.08 in the 0–10 group to a peak of 1,803.04 in the 71–80 group (Figure 1). Females comprised the majority at 7,101(75.74%). Of all evaluated cases, 6,635 (70.8%) were diagnosed by histology, 2,016 (21.5%) by cytology, and 724 (7.7%) underwent additional immunohistochemical analysis. Lymph node involvement was identified in 25.0% of cases, while nodes were not sampled in 49.3%. Invasive ductal carcinoma was the most frequently diagnosed cancer at 2,392 (25.5%) cases, followed by papillary thyroid carcinoma at 1,186 (12.7%) cases and unspecified adenocarcinoma at 639 (6.8%) (Table 2).

Head and neck lesions were the single largest category (2,903 cases, 30.97%), followed by thoracic region (2,556 cases, 27.26%). Multi-regional involvement was 17.30%, while abdominal

Table 1. Age-Specific Cancer Incidence Rates

Age group, n (%)	n (%)	Population	Ratio	Crude Rate per 100,000	Weighted Rate
<10	50 (0.53)	495,803	21.9	10.08	2.207
11-20	142 (1.51)	489,567	21.6	29.0	6.264
21-30	699 (7.46)	426,132	18.8	164.03	30.838
31-40	1,819 (19.40)	326,470	14.4	557.17	80.2325
41-50	2,506 (26.73)	243,584	10.7	1028.8	110.0816
51-60	1,828 (19.50)	134,611	5.9	1357.9	80.116
61-70	1,359 (14.50)	84,910	3.7	1600.52	59.219
71-80	747 (7.97)	41,430	1.8	1803.04	32.455
>80	223 (2.38)	25,543	1.1	873.03	9.60
NA	2 (0.02)	-	-	-	-
Total	9,375 (100.0)	2,268,050	100.0	-	411.01

NA: *Not available*

(7.03%), pelvic (5.43%), extremity (upper 7.94%, lower 0.77%), axial skeleton (1.19%), and integumentary/soft tissue (2.11%) sites made up the rest (Table 3). Within the head and neck, the thyroid gland and associated lymph nodes constituted the majority of cases 2,208 (99.68%). In the thoracic region, the breast was the most frequently affected site 1,980 (77.5%), while the pulmonary system accounted for 468 cases (18.3%). Abdominal organs represented 659 cases (7.03%) (Table 3).

Among the diagnostic procedures, excisional and incisional biopsy was the most frequently performed (2,300 cases, 24.5%), followed by fine needle aspiration (1,247 cases, 13.3%) and core needle biopsy (1,222 cases, 13.0%). In contrast, therapeutic interventions included total thyroidectomy with or without lymph node dissection (1,492 cases, 15.9%), wide local excision alone (415 cases, 4.4%), wide local excision with lymph node dissection (385 cases, 4.1%), mastectomy with lymph node dissection (275 cases, 2.9%), and mastectomy without lymph node dissection (270 cases, 2.9%) (Table 4).

The median tumor size was 5.1 mm (IQR 2.2–22.0 mm) in cases with free resection margins, compared to 8.5 mm (IQR 4.0–17.0 mm) in cases with positive margins, with the difference being statistically significant ($p < 0.001$) (Figure 2). Patients with lymph node involvement had significantly larger tumor sizes (median: 5 mm, QR: 2.3–20 mm, mean: 13.4 mm) compared to those without lymph node involvement (median: 4 mm, QR: 1.5–15 mm, mean: 10.6 mm) ($p = 0.018$) (Figure 3).

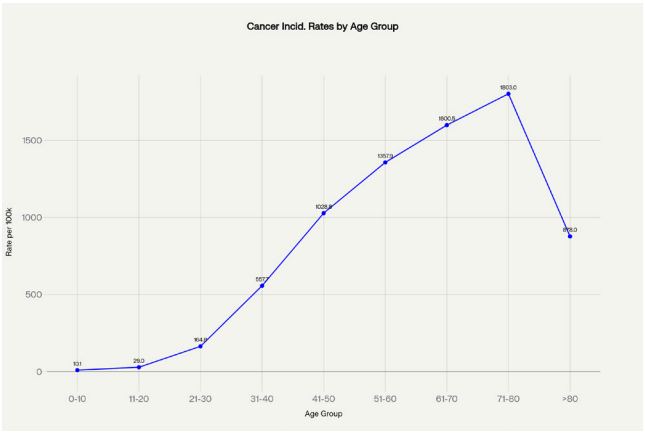

Figure 1. Incidence Rate of Cancer per 100,000 Population Across Different Age Groups.

Table 2. Baseline Characteristics

Variables	Frequency (%)
Age, Median (QR)	48.0 (39.0-60.0)
Gender	
Female	7,101 (75.74)
Male	2,274 (24.26)
Nationality	
Iraqi	9,363 (99.87)
Turkish	4 (0.04)
Bangladeshi	1 (0.01)
British	3 (0.03)
Pakistani	1 (0.01)
NA	3 (0.03)
Anatomical location of the lesion	
Breast & Head & Neck	6,952 (74.1)
Gastrointestinal tract	1,243 (13.3)
Cardiothoracic / Cardiovascular	387 (4.1)
Dermatology	167 (1.8)
Pulmonology / Respiratory	152 (1.6)
Orthopedics	152 (1.6)
ENT & Maxillofacial	140 (1.5)
Oncology	92 (1.0)
Neurology / Neurosurgery	34 (0.4)
Radiology	32 (0.3)
Ophthalmology	17 (0.2)
Pediatrics	7 (0.1)
Definitive diagnosis approach	
Histology	6,635 (70.8)
Cytology	2,016 (21.5)
Immunohistochemistry	724 (7.7)
Resection free margin	
Yes	2,324 (24.8)
No	995 (10.6)
Can not be assessed	1,980 (21.1)
NA	4,076 (43.5)
Tumor size (mm), Median (QR)	6.0 (2.0-15.0)
Lymph node involvement	
Yes	2,344 (25.0)
No	1,431 (15.3)
NA	5,600 (59.7)
Type of cancer	
Invasive ductal carcinoma	2,392 (25.5)
Papillary thyroid carcinoma	1,186 (12.7)
Adenocarcinoma (unspecified)	639 (6.8)
Ductal carcinoma in situ	443 (4.7)
Metastatic carcinoma (all sites)	311 (3.3)
Basal cell carcinoma	209 (2.2)
Invasive lobular carcinoma	205 (2.2)
Urothelial carcinoma	193 (2.1)
Squamous cell carcinoma (all sites)	139 (1.5)
Medullary thyroid carcinoma	60 (0.6)
Hodgkin lymphoma (all types)	69 (0.7)
Follicular thyroid carcinoma	55 (0.6)
Invasive mammary carcinoma	53 (0.6)
Sarcoma (all types)	26 (0.3)
Malignant melanoma	8 (0.1)
Other (each <0.1%)	3,387 (36.1)

QR: *Quartile range,* ***ENT:*** *Ear, Nose, and Throat,* ***NA:*** *Not available*

Table 3. Frequency of Malignant Lesions Across Anatomical Regions

Variables	Frequency (%)
Head and neck	**2,903 (30.97)**
Endocrine (Head and Neck)	**2,215 (76.3)**
Thyroid	2,208 (99.68)
Thyroglossal duct	5 (0.23)
Thymus	2 (0.09)
Cervical Region	**363 (12.5)**
Cervical/Cervical lymph node	236 (65.01)
Neck	52 (14.32)
Larynx	16 (4.41)
Throat	13 (3.58)
Vocal Cord	12 (3.31)
Pharynx	9 (2.48)
Head	6 (1.65)
Tonsil	6 (1.65)
Trachea	5 (1.38)
Supraglottic	4 (1.10)
Nasopharyngeal	4 (1.10)
Facial Region	**174 (6.0)**
Nose	59 (33.91)
Eye	30 (17.24)
Lip	21 (12.07)
Tongue	19 (10.92)
Mandible	10 (5.75)
Cheek	8 (4.60)
Face	7 (4.02)
Palate	7 (4.02)
Mouth	6 (3.45)
Forehead	3 (1.72)
Jaw	2 (1.15)
Chin	1 (0.57)
Maxilla	1 (0.57)
Salivary System	**74 (2.5)**
Parotid/Parotid Gland	42 (56.76)
Submandibular	30 (40.54)
Submental	2 (2.70)
Cranial and Neural	**45 (1.6)**
Brain	30 (66.7)
Skull	15 (33.3)
Auricular	**32 (1.1)**
Ear	29 (90.63)
Auricle	3 (9.37)
Thoracic Region	**2556 (27.26)**
Breast	**1,980 (77.5)**
Breast	1,978 (99.90)
Intramammary	2 (0.10)
Pulmonary System	**468 (18.3)**
Lung	387 (82.70)
Bronchi	58 (12.39)
Pleura	23 (4.91)
Mediastinum	**62 (2.4)**
Esophagus	37 (59.68)
Mediastinum/Mediastinal lymph node	25 (40.32)
Chest Wall	**39 (1.5)**
Chest/Chest wall	20 (51.28)
Clavicle	7 (17.95)
Rib	6 (15.38)
Sternum	4 (10.26)
Suprasternal	2 (5.13)
Cardiovascular	**7 (0.3)**
Heart	4 (57.14)
Aorta	3 (42.86)
Abdominal Region	**659 (7.03)**
Hepatobiliary and Upper GI tract	**288 (43.7)**
Liver	157 (54.51)
Stomach	93 (32.29)
Pancreas	15 (5.21)
Gallbladder	10 (3.47)
Duodenum	5 (1.74)
Spleen	5 (1.74)
Bile Duct	3 (1.04)
Large Intestine	**153 (23.2)**
Colon	144 (94.12)
Appendix	5 (3.27)
Cecum	4 (2.61)
Retroperitoneal Organs	**112 (17.0)**
Kidney	101 (90.18)
Adrenal Gland	9 (8.04)
Retroperitoneum	2 (1.78)
Peritoneal and Mesenteric Structures	**98 (14.9)**
Peritoneum	81 (82.65)
Omentum	15 (15.31)
Mesentery	2 (2.04)
Small Intestine	**8 (1.2)**
Ileum	7 (87.5)
Jejunum	1 (12.5)
Pelvic sites	**509 (5.43)**
Urological	**315 (61.9)**
Bladder	181 (57.46)
Prostate	100 (31.75)
Male Genital	24 (7.62)
Urethra	10 (3.17)
Colorectal	**98 (19.3)**
Rectum	61 (62.25)
Sigmoid	33 (33.67)
Anal	4 (4.08)

Table 3. Continued...

Gynecological region	**76 (14.9)**
Uterus	43 (56.58)
Ovary	20 (26.32)
Vagina	6 (7.89)
Vulva	7 (9.21)
Pelvic	**20 (3.9)**
Pelvis	20 (100.0)
Upper Extremity	**744 (7.94)**
Shoulder Girdle	**715 (96.1)**
Axilla	713 (99.72)
Shoulder	2 (0.28)
Arm region	**29 (3.9)**
Upper-arm	19 (65.52)
Humerus	4 (13.79)
Hand	4 (13.79)
Brachial	2 (6.90)
Lower Extremity	**72 (0.77)**
Leg region	**37 (51.4)**
Leg	26 (70.27)
Foot	8 (21.62)
Knee	3 (8.11)
Hip and Thigh	**35 (48.6)**
Thigh	28 (80.0)
Hip	7 (20.0)
Axial Skeleton	**112 (1.19)**
Spine	**37 (33.0)**
Vertebrae	15 (40.54)
Spine	8 (21.62)
Sacrum	8 (21.62)
Paravertebral tissue	6 (16.22)
Lymphatic System	**75 (67.0)**
Regional Nodes	75 (100.0)
Integumentary and Soft Tissue	**198 (2.11)**
Integument	**175 (88.4)**
Skin	171 (97.71)
Others	4 (2.29)
Gastrointestinal Region	**23 (11.6)**
Intestine/ Small intestine	18 (78.26)
Bowel/ Small bowel	5 (21.74)
Multi-Region Combination	**1622 (17.30)**
Thoracic Region	**1232 (76.0)**
Breast + Axilla / Supraclavicular / Clavicular regions	1210 (98.21)
Axilla + Supraclavicular/ Inguinal lymph nodes	15 (1.22)
Lung + Bronchi / Pleura / Mediastinal / Carinal / Subcarinal lymph nodes	7 (0.57)
Head and Neck Combinations	**333 (20.5)**
Thyroid gland + Cervical / Neck lymph nodes	303 (91.0)
Cervical lymph nodes + Larynx / Tongue / Tonsil / Nose / Oral cavity	8 (2.40)
Cervical lymph nodes + Ear / Parotid / Submandibular glands	7 (2.10)
Cervical lymph nodes + Axillary lymph nodes	6 (1.80)
Lip + Face / Submental / Cervical lymph nodes	6 (1.80)
Nose + Mouth / Ear	3 (0.90)
Pelvic Region	**33 (2.0)**
Sigmoid + Rectum	13 (30.40)
Uterus + Ovaries	9 (27.27)
Ovary + Colon / Peritoneum / Omentum	8 (24.24)
Rectum + Liver / Bladder	3 (9.09)
Abdominal Region	**18 (1.1)**
Stomach + Duodenum / Pylorus / Colon / Spleen / Gallbladder	8 (44.44)
Colon + Liver / Kidney / Jejunum / Anus	6 (33.33)
Ileum + Omentum + Peritoneum	1 (5.56)
Kidney + Liver	1 (5.56)
Liver + Omentum	1 (5.56)
Pancreas + Spleen	1 (5.56)
Lymphatic Focused Sites	**6 (0.4)**
Thyroid gland + Pretracheal / Paratracheal lymph nodes	5 (83.3)
Thigh + Inguinal lymph nodes	1 (16.7)

4. Discussion

Despite advances in global cancer surveillance, accurately capturing the true burden of cancer survivorship remains challenging, particularly in low- and middle-income countries. Although survival data from these regions have expanded in recent years, they often lack sufficient granularity for effective local health planning and policy development [12]. Against this backdrop, the present study provides detailed institution-level prevalence data from a tertiary care center in Iraq, offering valuable insights into the demographic, epidemiological, and clinical characteristics of cancer patients in this setting.

Age is a well-established risk factor for cancer development [13]. In the present study, the median age at diagnosis was 48.0 years, reflecting an earlier onset compared with most Western populations. This pattern aligns with broader epidemiological data from the Middle East, where cancers tend to present one to two decades earlier than in Western countries. Comparable medians have been reported in Jordan (55–56 years) [14,15] and Palestine (55 years) [16], while in a study from Basra, Iraq, which analyzed 2,163 cancer cases in 2017, the mean age was 51.4 ± 19.6 years [17]. In contrast, data from the U.S. National Cancer Institute's

Table 4. Frequency of Major Surgical and Biopsy Procedures

Procedure/Operation	Frequency (%)
Excisional and Incisional Biopsy	2300 (24.5)
Fine Needle Aspiration	1247 (13.3)
Total Thyroidectomy (with/without LND)	1492 (15.9)
Core Needle Biopsy	1222 (13.0)
Wide Local Excision	415 (4.4)
Wide Local Excision with LND	385 (4.1)
Mastectomy with LND	275 (2.9)
Mastectomy	270 (2.9)
Mass Excision (with/without Lymph Node)	233 (2.5)
Mastectomy with Lymph Node Biopsy	209 (2.2)
Transurethral Resection of Bladder Tumor	171 (1.8)
Wide Local Excision with Lymph Node Biopsy	161 (1.7)
Thyroid Lobectomy (with/without LND or Isthmectomy)	145 (1.5)
Lymph Node Dissection	103 (1.1)
Mass Resection (with/without Lymph Node)	102 (1.1)
Bronchial Biopsy	77 (0.8)
Colectomy	69 (0.7)
Nephrectomy	67 (0.7)
Lobectomy (with/without Lymph Node Biopsy)	65 (0.7)
Hysterectomy with Salpingo Oophorectomy	31 (0.3)
Bronchial Washing	22 (0.2)
Orchiectomy	18 (0.2)
Transurethral Resection of the Prostate	17 (0.2)
Sigmoidectomy	16 (0.2)
Whipple Operation	15 (0.2)
Pneumonectomy	14 (0.1)
Gastrectomy (Subtotal / Total ± Splenectomy)	24 (0.3)
Glossectomy (Total/Partial) (with/without LND)	12 (0.1)
Dilatation and Curettage	12 (0.1)
Esophagogastroduodenoscopy	9 (0.1)
Colonoscopy	8 (0.1)
Cystectomy	8 (0.1)
Superficial or Total Parotidectomy (with/without LND)	26 (0.3)
Thyroid Isthmectomy	14 (0.1)
Lymph Node Biopsy	8 (0.1)
Hysterectomy	8 (0.1)
Lymph Node Resection	6 (0.1)
Lumpectomy (with/without LND)	6 (0.1)
Subtotal Colectomy	6 (0.1)
Appendectomy	6 (0.1)
Breast Revision Surgery (with/without Lymph Node Biopsy)	5 (0.1)
Thyroid Nodulectomy	11 (0.1)
Cholecystectomy	4 (0.04)
Metastasectomy	4 (0.04)
Amputation	3 (0.03)
Hepatectomy	3 (0.03)
Nephrectomy with LND	3 (0.03)
Pelvectomy	3 (0.03)
Prostatectomy (with/without LND)	4 (0.04)
Segmentectomy	3 (0.03)
Thyroid Nodulectomy with LND	3 (0.03)
Tonsillectomy	3 (0.03)
Adrenalectomy	2 (0.02)
Esophagectomy	2 (0.02)
Eye enucleation	2 (0.02)
Microdochectomy	2 (0.02)
Pancreatectomy	2 (0.02)
Polypectomy	2 (0.02)
Vulvectomy	2 (0.02)
Splenectomy	2 (0.02)
Total Laryngectomy with LND	2 (0.02)
Tonsillectomy with Lymph Node Biopsy	2 (0.02)
Hepatic lobectomy	1 (0.01)
Maxillectomy	1 (0.01)
Oophorectomy	1 (0.01)
Pancreatectomy with Splenectomy	1 (0.01)
Pap test	1 (0.01)
Paracentesis	1 (0.01)
Parathyroidectomy	1 (0.01)
Pneumonectomy with LND	1 (0.01)
Subtotal Thyroidectomy	1 (0.01)
Wedge Resection	1 (0.01)
NA	2 (0.02)

LND: Lymph node dissection, ***NA:*** Not available

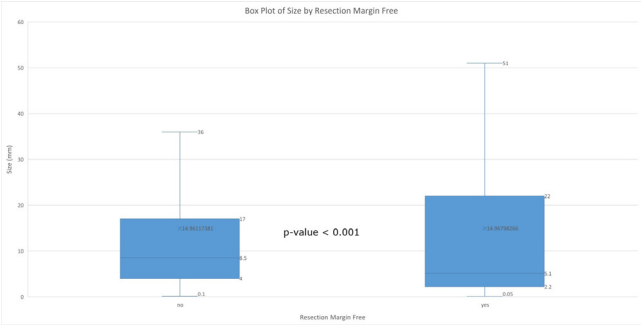

Figure 2. Box Plot of Size by Resection Margin Free.

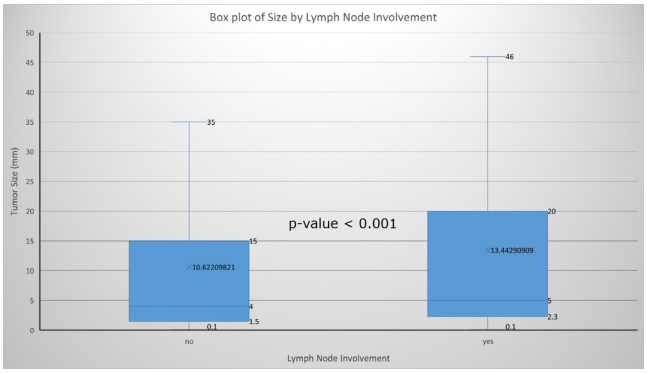

Figure 3. Box Plot of Size by Lymph Node Involvement

Surveillance, Epidemiology, and End results program indicate a median cancer diagnosis age of 67 years, with individual cancers occurring at even older ages, lung (71), prostate (68), colorectal (66), and breast (63 years) [18]. Peak cancer incidence in this study occurred in the 71–80 age group, with 1,803 per 100,000 population, indicating that age-related cancer burden is increasingly affecting Iraq's population. This pattern is consistent with national cancer registry data, which report the highest incidence among individuals aged 70–79 years [19]. In high-income countries, peak incidence occurs at slightly older ages and higher rates, such as 2,500 per 100,000 in U.S. adults aged 80–84 years [20] or adults ≥75 years comprising 36% of new UK cases [21]. In this study, the declining pattern in cancer incidence observed after the age of 80 was likely due to competing mortality, whereby many elderly individuals die from other conditions before cancer can be diagnosed; diagnostic underestimation, as very old patients are less likely to undergo extensive investigations; and population structure, since the >80 group made up only 1.1% of the total population, making the rates more sensitive to small changes in case numbers.

The age-standardized incidence rate (ASR) in this study was 82.20 per 100,000 population, consistent with low- and middle-income country figures but lower than the 2022 global ASR of 198 per 100,000 [22]. Regional ASRs vary: high-incidence countries like Cyprus, Israel, and Turkey report 196–340 per 100,000, while Jordan reports moderate ASRs of 131–137 per 100,000 [23]. The overall Arab countries' ASR is ~132 per 100,000 [22], whereas high-income nations may exceed 300 per 100,000, with Australia at ~468 per 100,000 [24]. The relatively low ASR in this study may reflect Iraq's younger demographic, limited screening, underreporting, registry limitations.

In this single-center series, head and neck lesions constituted the largest category, with 2,903 cases (30.97%), followed by thoracic lesions with 2,556 cases (27.26%). This distribution differs markedly from national cancer trends. Iraqi registries consistently identify breast and lung cancers as the most common malignancies, with bladder cancer leading in men; notably, breast cancer alone accounted for 19.5% of all malignancies in 2012 [25]. Similarly, a nine-year study from Karbala found head and neck tumors to represent only 2.7% of cancers [26]. Globally, head and neck cancers rank among the ten most common malignancies, with around 900,000 new cases annually [26]. In the UK, they are the eighth most common cancer, comprising 3% of new cases (approximately 12,400 per year), with peak incidence between 60–64 years [21]. Since the early 1990s, incidence rates in the UK have risen by over 35%, with a nearly 47% increase among females [27, 28]. The unusually high proportion of head and neck lesions in this study most likely reflects referral patterns rather than the true population-based incidence.

The thoracic category represented the second most common group in the current series, accounting for 27.26% of cases. This pattern is consistent with Iraq's known cancer burden, where breast cancer is the most prevalent malignancy among women, comprising approximately 19–34% of female cancers [25]. A study from the Basra Cancer Control Centre analyzing 2,163 cases also highlighted bladder and lung cancers as the leading malignancies among men [17]. National statistics further confirm breast and lung cancers as the two most common cancer types overall. The prominence of thoracic cases in the present study is therefore not unexpected. Globally, lung cancer remains a major health challenge, with an estimated 2.2 million new cases and 1.8 million deaths reported in 2020, making it the leading cause of cancer-related mortality worldwide. Recent data from the International Agency for Research on Cancer (2025) indicate that lung adenocarcinoma has become the predominant histological subtype, with rising incidence particularly among younger populations and females [29,30].

Cancers of the abdomen (7.03%) and pelvis (5.43%) were less frequent compared to global trends. Worldwide, colorectal cancer is among the top three cancers in incidence and mortality, comprising approximately 10% of global cancer cases [10]. The lower proportion in this dataset might reflect underdiagnosis, referral patterns, or differences in lifestyle factors like diet and obesity, which are known contributors to colorectal carcinogenesis [31]. Similarly, the relatively low prevalence of integumentary/soft tissue cancers (2.11%) is consistent with global data, where soft tissue sarcomas are rare, accounting for less than 1% of all cancers in developed countries [32].

Globally, thyroid cancer was the tenth most common malignancy in 2020, with about 586,000 new cases (≈3% of all cancers), predominantly affecting women [33]. In this study, however, thyroid cancer comprised nearly a quarter of cases, far exceeding regional expectations. For comparison, a Saudi tertiary center reported overall rate of 9% (12% in women) [34], whereas Iraqi registry data from 2012 did not list thyroid as one of the leading sites [25]. Globocan 2020 ranked thyroid cancer as the second most common cancer in Iraqi women (5.8%) [10]. This unusually high proportion likely reflects referral bias, as the center specializes in endocrine disorders and thyroid surgery. Conversely, several major cancers were underrepresented. Lung, colorectal, bladder, liver, and prostate cancers each accounted for only 1–4% of cases, compared with much higher global and national figures. Worldwide, lung cancer alone contributed 12.4% of new cases in 2022 and remains the leading cause of cancer death [3], whereas it was only 4.13% (387/9,375) here. Colorectal cancer was 1.5% (98/9,375) compared to 9.6% globally and 6.2% in Iraq [3,10]. Similarly, rates for bladder (1.9%), liver (1.7%), and prostate (1.1%) were well below both global averages and Iraqi data [3,10]. These discrepancies again point to strong referral and selection factors rather than true incidence.

The predominance of invasive ductal carcinoma in this cohort is consistent with global epidemiology, as it remains the most common form of breast cancer, representing 70–80% of invasive cases [35–37]. In the United States alone, about 276,000 women are diagnosed annually, with most cases occurring in those over 50 years [36]. Invasive lobular carcinoma, the second most common subtype, accounted for 2.2% of cases here, similar to SEER data showing its position behind ductal carcinoma [38]. Long-term analyses indicate stable ductal carcinoma rates but increasing lobular and mixed ductal-lobular subtypes over recent decades [39]. Ductal carcinoma in situ, observed in 4.7% of cases, reflects the influence of screening programs, with contemporary data showing it accounts for 20–25% of newly diagnosed breast cancers in the U.S., largely mammography-detected [40].

Papillary thyroid carcinoma comprised 12.7% of cases, aligning with global trends of increasing thyroid cancer incidence. It constitutes about 84% of all thyroid cancers, with a 3:1 female predominance, and its incidence rose from 9.9 to 16.1 per 100,000 between 2003 and 2017 before stabilizing in recent years [41]. Revisions in diagnostic criteria, particularly reclassifying certain follicular variants as in situ tumors, have slowed reported growth. Regional data illustrate heterogeneity, with a study from Jordan reporting papillary carcinoma increases from 89.6% to 94% of thyroid cases [42]. Follicular and medullary thyroid carcinomas were less frequent but remain important subtypes with distinct epidemiological features; notably, follicular carcinoma incidence rose by over 30% between the 1980s and 2000s [43]. Skin cancers were also represented, with basal cell carcinoma (2.2%) and squamous cell carcinoma (1.5%). Basal cell carcinoma is the most common skin cancer globally, with steadily rising incidence over the past decades [44]. Squamous cell carcinoma shows wide geographic variation, with plateauing or declining rates in Australia, stable rates in the U.S., but increases in Europe [45]. Hodgkin lymphoma, comprising 0.7% of cases, remains rare but is the most common cancer among adolescents. Recent U.S. rates are 3.8 per 100,000 in men and 2.9 per 100,000 in women, with a modest overall decline since 2000 [46]. Globally, incidence varies, highest in Southern Europe and lowest in Eastern Asia, with rising trends in younger populations, females, and Asian countries [47]. Urothelial carcinoma (2.1%) reflects its role as the predominant bladder cancer subtype, comprising ~90% of cases. In the U.S., ~84,870 new bladder cancers are reported annually, with a 4:1 male predominance [48]. Upper tract urothelial carcinoma, while rare (~2 per 100,000), contributes 5–10% of urothelial malignancies [49].

Biopsy and diagnostic procedures constituted the overwhelming majority of interventions (53.42%, n=5,017), with incisional and excisional biopsy being the most common procedure (24.5%, n=2,300), followed by fine needle aspiration (13.3%, n=1,247) and core needle biopsy (13.0%, n=1,222). This pattern reflects the critical importance of tissue diagnosis in cancer management, consistent with international guidelines that emphasize histopathological confirmation as the cornerstone of cancer diagnosis [50]. The high frequency of fine needle aspiration biopsy aligns with Iraqi studies demonstrating its effectiveness, with reported sensitivity rates of 87.3-96% and specificity rates of 83-100% for breast lesions, making it a preferred initial diagnostic tool due to its minimal invasiveness and cost-effectiveness [51,52]. Studies from other Middle Eastern centers have similarly reported high utilization of fine needle aspiration and core needle biopsies, particularly for superficial lesions and thyroid nodules [53].

Thyroid surgery represented the second most common category (18.36%, n=1,733), with total thyroidectomy (with/without lymph node dissection) being the predominant procedure (15.9%). The preference for total thyroidectomy over thyroid lobectomy (1.5%) and isthmectomy (0.1%) aligns with international guidelines for differentiated thyroid cancer, particularly for tumors larger than 4 cm or those with aggressive histological features. The high frequency of total thyroidectomy in this series is consistent with the current trend toward more aggressive surgical management for thyroid cancer in developing countries, where patients often present at more advanced stages [54].

Breast surgery accounted for 8.20% of procedures, with mastectomy-related procedures representing 754 cases. The predominance of mastectomy over breast-conserving surgery reflects the pattern observed throughout Iraq, where modified radical mastectomy remains the standard approach for breast cancer treatment. Studies from the Kurdistan region of Iraq show that 60.2% of breast cancer patients undergo mastectomy compared to 39.8% receiving breast-conserving surgery, with the proportion of breast-conserving surgery slowly increasing from 36.3% in 2016 to 43.7% in 2021 [55]. This mastectomy preference contrasts with international trends in developed countries where breast-conserving surgery is increasingly favored for early-stage disease [56].

This study has several limitations. First, potential referral bias may affect the representativeness of the findings, as the unusually high proportion of head and neck and thyroid cancers likely reflects the center's specialized role rather than true population-based cancer incidence. The five-year study period and single-center setting further limit the generalizability of the results to broader populations. Finally, the absence of survival data and cancer staging information restricts the ability to assess outcomes and prognosis within the studied population.

5. Conclusion

The study highlights a unique cancer profile, with younger age at diagnosis and higher rates of head, neck, and thyroid cancers. These findings underscore the need for targeted screening and prevention strategies adapted to regional healthcare systems and population risks.

Declarations

Conflicts of interest: The authors have no conflicts of interest to disclose.

Ethical approval: Ethical approval for this study was obtained from the Ethical Committee of Kscien Organization (Approval No. 41/2025).

Consent for participation: Not applicable.

Consent for publication: Not applicable

Funding: The present study received no financial support.

Acknowledgments: None to be declared.

Authors' contributions: AMM, and FHK: Major contribution to the conception and design of the study, literature search, and manuscript drafting. ARA, DAH, FA, MSE, HSA, LQR, MAK, DGH and HHR: literature review, study design, data collection, and critical revision of the manuscript. BAA, and SJH: literature review, table and figure processing. All authors have read and approved the final version of the manuscript.

Use of AI: ChatGPT-4.5 was used to assist with language refinement and improve the overall clarity of the manuscript. All content was thoroughly reviewed and approved by the authors, who bear full responsibility for the final version.

Data availability statement: Data are available from the corresponding author upon reasonable request..

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