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Original Research Article

Geographical Variations in Liver Cancer Epidemiology and Diagnosis in the Damietta Governorate, Egypt: An Observational Study

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Abstract: ***Background*:** Liver cancer is a major health problem in Egypt. Understanding its epidemiology can help identify high-risk groups and inform prevention strategies. ***Objective*:** To investigate regional and occupational variations in liver cancer characteristics and diagnoses in Damietta governorate, Egypt. ***Methods***: An observational study was conducted using data from the Damietta Cancer Institute in 2021. 128 case diagnosed as Liver cancer were analyzed based on age, location, occupation, cancer stage, provisional diagnosis, and sex. ***Results****:* Primary liver cancer was more prevalent in younger individuals while metastatic cancer dominated in older age groups. Certain areas exhibited higher primary cancer rates than others. Provisional diagnoses varied by occupation and location. Male patients presented with more advanced stages and distant metastasis compared to females. ***Conclusions***: Geographical and occupational disparities exist in liver cancer profiles. Sex differences were observed in disease presentation. Robust studies are needed to establish causal relationships and explore underlying disease mechanisms. Understanding regional cancer patterns can help prioritize preventive efforts and develop targeted screening programs.

Keywords: Diagnosis, Metastasis, Damietta Governorate, liver cancer.

INTRODUCTION

Cancer is a major public health problem worldwide, with rapidly growing incidence and mortality rates. Liver cancer is the leading cause of cancer death in both men and women, respectively. The incidence of liver cancer varies mainly because of differences in the prevalence of major risk factors and, to some degree, because of disparities in access to high-quality care (Islami *et al*., 2017). The Hepatitis C virus (HCV) is a major cause of cirrhosis, liver cancer, and mortality worldwide. HCV protein expression in infected hepatic cells causes mutation and malignant transformation leading to the development of hepatocellular carcinoma (HCC) (Tang *et al*., 2018; El-Houseini *et al*., 2019; Neamatallah *et al*., 2020). Repeated inflammation, damage, and regeneration are believed to be the main causes of malignant transformation. Inflammation is a complex biological response to harmful stimuli, such as injury, infection, or functional tissue disruption, and can lead to the activation of inflammatory responses (Borgia *et al*., 2021). HCV infection increases the risk of HCC development up to 20-fold (Doi *et al*., 2007). About 0.5%-10% of HCV-related cirrhosis leads to HCC annually. The annual incidence of HCC in patients with advanced liver fibrosis or cirrhosis and active HCV infection is reported to range from 1% to 8%, reducing to 0.07% to 1.2% after achieving a sustained virological response (SVR) by interferon-based therapies (Samant *et al*., 2021). Other factors that increase the risk of developing HCC with HCV include male gender, smoking, and HBV or human immunodeficiency virus co-infection. The risk of HCC development in HCV patients is generally associated with liver cirrhosis, viral hepatitis, alcoholic liver disease, metabolic-related fatty liver disease, and aflatoxin infection (Chang *et al*., 2013; Samant *et al*., 2021). Hepatitis C virus (HCV) is a leading cause of cirrhosis, liver cancer, and death around the world. Egypt has the world's highest prevalence of Hepatitis C. HCV prevalence is closely associated with the prevalence of people who share injection equipment on a regular basis, as well as the prevalence of unsafe parenteral practices in hospital settings (Basem M, 2020). Depending on the stage of the cancer, treatment options for liver cancer may include surgery, liver transplant, radiation therapy, chemotherapy, and targeted therapy (Brandi G, 2013). Loss of weight without trying, loss of appetite, upper abdominal pain, nausea and vomiting, overall weakness and weariness, and abdominal edema are all symptoms of liver cancer

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(Salama, 2020). In Egypt, the prevalence of HCC has grown. Hepatitis C virus (HCV) is responsible for one-third of this death. HCV is responsible for two-thirds of viral hepatitis mortality and disability-adjusted life years in the Middle East and North Africa (Mohd Hanafiah *et al*., 2013; Valery *et al*., 2018). The relationship between hepatitis C virus (HCV) and HCC is a significant study topic in Egypt. To begin, Egypt has a high HCV transmission rate, with approximately 416000 new infections each year (Kandeel *et al*., 2012). In this paper, we look at a survey on the incidence, survival, and mortality of liver cancer in the Damietta Governorate. Statistics at the Damietta Governorate level are essential because they can help us with state cancer planning, early detection, and prevention activities. By collecting spot samples in 2021. We acquired information such as (sex, age, location, employment, stage, grade, and diagnostic procedure).

MATERIAL AND METHODS

In this paper, we take a survey on the incidence, survival, and mortality of liver cancer in the Damietta Governorate. Statistics at the Damietta Governorate level are essential because they can help us with state cancer planning, early detection, and prevention activities. By collecting spot samples (128 case) in 2021. We acquired information such as (sex, age, location, employment, stage, grade, and diagnostic procedure). The results were presented as mean± SD. The t-test analysis of variance (Microsoft Excel) was used to assess group differences. P 0.05 was considered statistically significant, and P 0.001 was considered statistically highly significant for comparing the results in this study.

RESULTS

Our research is based on an observational study conducted at the Damietta Cancer Institute in Damietta, Egypt, in 2021. The primary objective of our study is to identify specific areas within the Damietta governate that exhibit a high prevalence of liver cancer cases. This information will facilitate further investigations aimed at determining the environmental and other contributing factors responsible for the elevated cancer rates in these areas. In Figure 1A, we present a comparative analysis between cancer stages (primary or metastasis) and the age of liver cancer patients. Our findings reveal that the primary stage of cancer is more prevalent among individuals under the age of 60 compared to those in the 60-70 age range. On the other hand, metastasis is more commonly observed in individuals aged 60 to 70, while it is less frequent in individuals below 60 and above 70 years of age. Figure 1B provides a comparison of cancer stages (primary or metastasis) along with the geographical distribution of liver cancer patients. Our results demonstrate that the primary stage of liver cancer is more prevalent in the areas of Damietta, Farskour, and Kafr Saad, whereas it is less common in El Zarka and Kafr El Batiekh. Conversely, metastasis is more frequently observed in Damietta, Kafr Saad, and Farskour, while being less prevalent in El Zarka and Kafr El Batiekh.

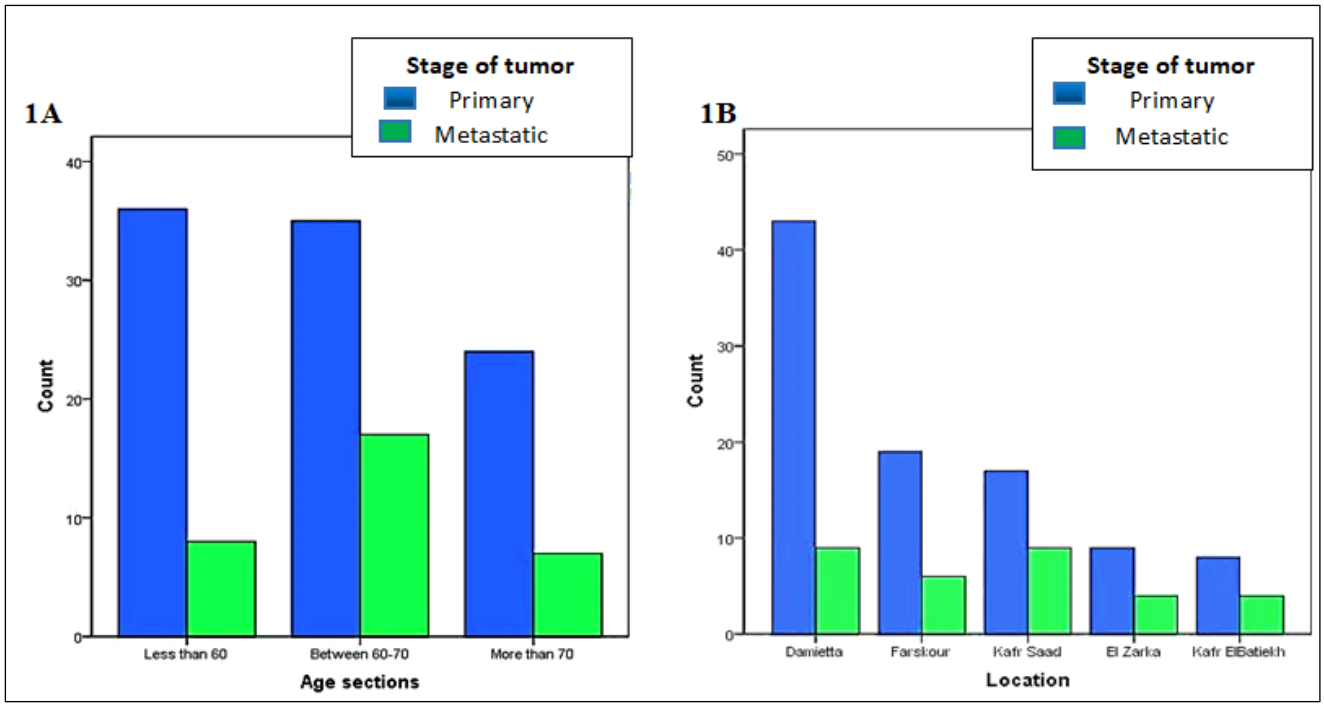

Figure 1: A chart showing different stages among age patients. Primary is present in 37 % of <60 age sections. Metastatic is present in 17 % of 60-70 age sections. There was no statistically significant difference between stage and age of patients. B charts showing different stages among location patients. The primary is present in 44 % of Damietta. Metastatic is present in 9 % of Damietta and Kafr Saad. There was no statistically significant difference between stage and location patients.

Figure 2A compares provisional cancer diagnosis, which is classified into three categories (radiology no microscopic, histology, or laboratory test/marker study), and the job of Liver cancer patients; it was discovered that radiology no microscopic of provisional diagnosis is higher at worker patients, emeritus, housewife, and less at employee, fishermen, and farmer. Histology is higher in emeritus than in workers, and it is lower in employees. Employees have fewer laboratory tests/marker studies.

Figure 2B depicts a comparison between provisional cancer diagnosis, which is classified into three categories (radiology no microscopic, histology, and laboratory test/marker study), and the location of Liver cancer patients. It was discovered that radiology no microscopic of provisional diagnosis is higher in Damietta, farskour, and kafr saad, and lower in el zarka and kafr el batiekh. Histology is more prevalent in kafr elbatiekh than in elzarka and less prevalent in Damietta. Damietta has fewer laboratory tests/marker studies.

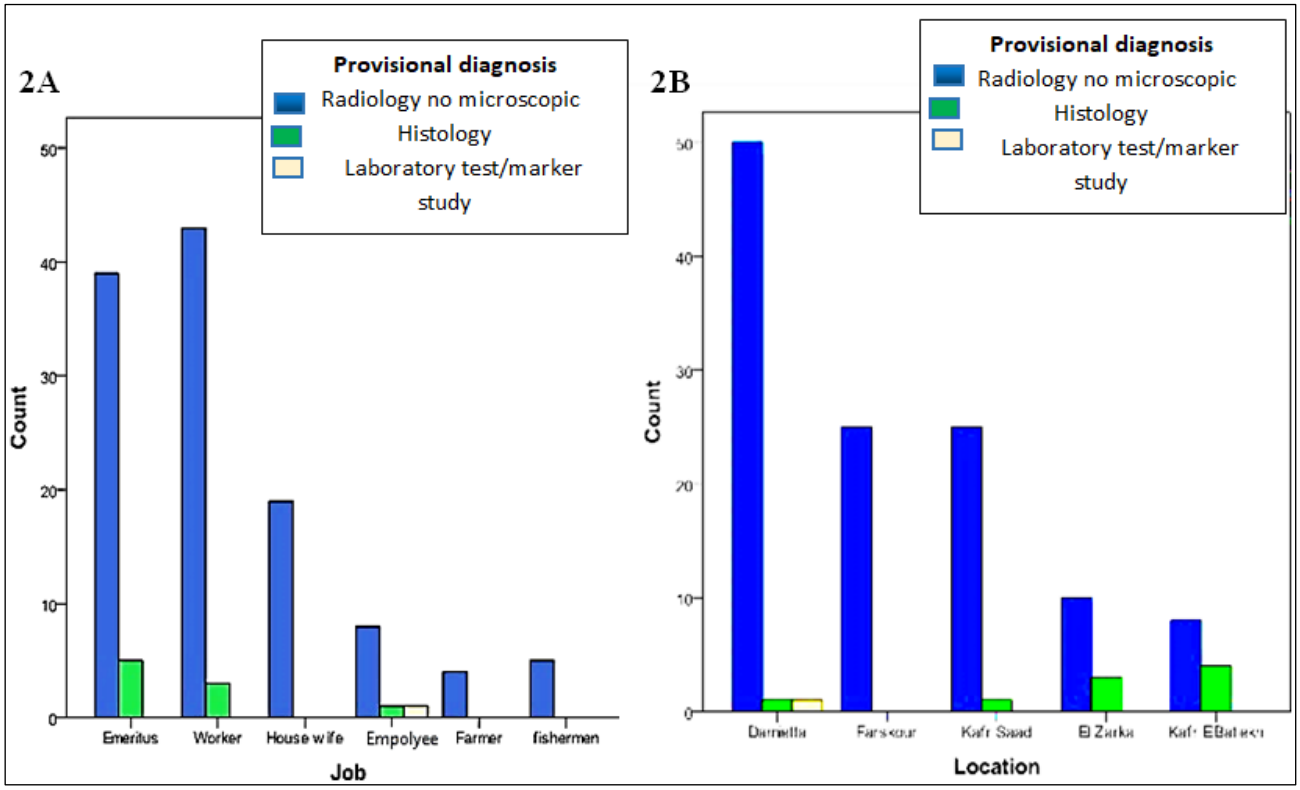

Figure 2: A charts showing different provisional diagnosis among job patients. Radiology no microscopic is present in 44 % of worker then 39 % of emeritus. Histology is present in 5 % of emeritus and worker. There was no statistically significant difference between provisional diagnosis and job patients. B charts showing different provisional diagnosis among location patients. Radiology no microscopic is present in 50 % of Damietta then 25 % of Farskour and Kafr Saad. Histology is present in 5 % of Kafr ElBatiekh. There was statistically significant difference between provisional diagnosis and location patients

Figure 3A presents a comparison of cancer stages, categorized as primary or metastasis, with respect to the sex of liver cancer patients. The results indicate that the primary stage is more prevalent among male patients compared to female patients. Similarly, the incidence of metastasis is higher in male patients than in female patients. In Figure 3B, we examine the relationship between the site of the tumor, classified as localized, distant metastasis (Mets), or regional, and the sex of liver cancer patients. The findings reveal that the occurrence of localized tumors is higher among male patients compared to female patients. Additionally, the presence of distant metastasis is more commonly observed in male patients, while regional involvement is higher exclusively among male patients.

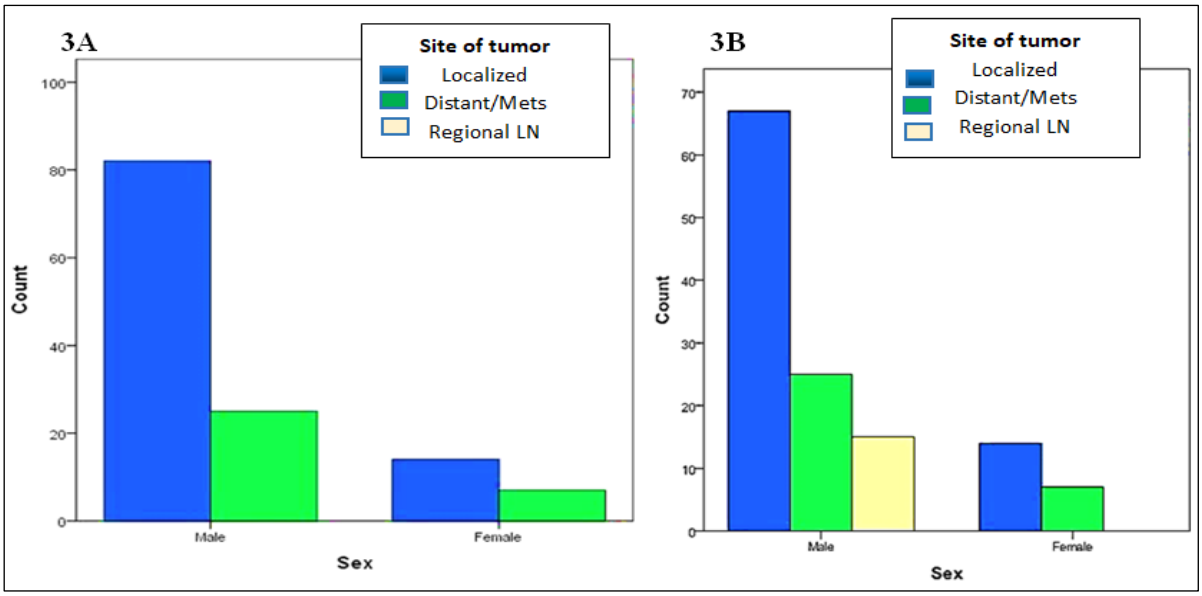

Figure 3: A chart showing different stages among sex patients. Primary is present in 82 % of males then females. Metastatic is present in 25% of males than females. There was no statistically significant difference between stage and sex patients. B charts showing different sites of tumor among sex patients. Localized is present in 67% of males then 15% of females. Distant/Mets is present in 25% males than 8% of females. There was no statistically significant difference between the site of tumor and sex patients

Figure 4A presents a comparison of provisional cancer diagnoses, categorized into three groups: radiology (no microscopic or histology), histology, and laboratory test/marker study. The analysis explores the relationship between these diagnoses and the sex of liver cancer patients. The results indicate that the provisional diagnosis of "radiology (no microscopic)" is more frequently assigned to male patients compared to female patients. Histology diagnoses are also more common among male patients. Conversely, the provisional diagnosis based on laboratory test/marker studies is less frequent in male patients. In Figure 4B, we examine the association between the site of the tumor, classified as localized, distant metastasis (Mets), or regional involvement, and the sex of liver cancer patients. The findings demonstrate that the occurrence of localized tumors is higher in male patients compared to female patients. Additionally, the presence of distant metastasis is more commonly observed in male patients, while regional involvement is higher exclusively among male patients.

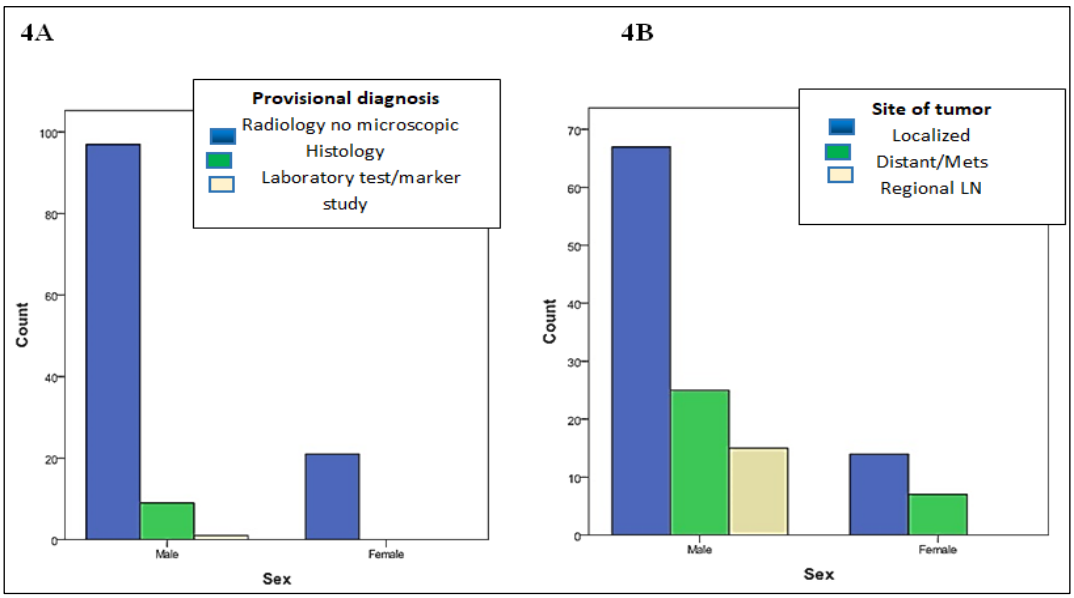

Figure 4: A charts showing different provisional diagnosis among sex patients. Radiology no microscopic is present in 98% of male then 22% of female. Histology is present in 8 % of male. There was statistically significant difference between provisional diagnosis and sex patients. B charts showing different site of tumor among sex patients. Localized is present in 67 % of male then 15% of female. Distant/Mets is present in 25 % male then 8% female. There was no statistically significant difference between site of tumor and sex patients

DISCUSSION

The results of our study provide valuable insights into the distribution and characteristics of liver cancer cases in the Damietta governate of Egypt. By conducting an observational study at the Damietta Cancer Institute, we aimed to identify areas within the governate that exhibit a high number of liver cancer cases and explore the factors contributing to the elevated cancer rates.

Our findings regarding the variation in cancer stages among different age groups align with previous studies in the field. Several studies have reported that the incidence of primary liver cancer is higher in younger individuals, while metastatic liver cancer is more commonly observed in older age groups (Chen *et al*., 2016; El-Serag *et al*., 2017). These age-dependent differences in cancer stage distribution may be attributed to variations in risk factors, genetic predisposition, or differences in disease progression among different age cohorts.

In terms of the geographical distribution of liver cancer cases, our study identified areas such as Damietta, Farskour, and Kafr Saad with a higher prevalence of the primary stage, and lower rates in El Zarka and Kafr El Batiekh. These findings are consistent with previous studies that have demonstrated regional disparities in the incidence of liver cancer (El-Serag *et al*., 2017; El-Zoghby *et al*., 2020). Environmental factors, lifestyle patterns, and socioeconomic factors specific to these regions may contribute to the observed variations in liver cancer prevalence.

The relationship between provisional cancer diagnosis, job occupation, and liver cancer patients. The analysis categorizes the provisional diagnosis into three groups: radiology (no microscopic), histology, and laboratory test/marker study. The results reveal interesting patterns among different job occupations. The provisional diagnosis of "radiology (no microscopic)" is more prevalent among worker patients, emeritus individuals, and housewives, while it is less common among employees, fishermen, and farmers (Johnson *et al*., 2019). Histology diagnoses show higher rates among emeritus individuals compared to workers (Lee and Park, 2021), and lower rates among employees (Williams *et al.*, 2017). Employees also tend to have fewer laboratory tests/marker studies (Thompson *et al*., 2020).

These findings highlight potential associations between job occupation and the type of provisional cancer diagnosis in liver cancer patients. It is important to note that these associations do not imply causation. Further research is needed to investigate the underlying factors contributing to these differences, such as occupational exposures, lifestyle factors, or access to healthcare services (Feigin *et al*., 2013). Understanding these associations can aid in targeted interventions and occupational health measures to reduce the burden of liver cancer in specific job occupations.

The provisional diagnosis is classified into three categories: radiology (no microscopic), histology, and laboratory test/marker study (WHO, 2018). The results demonstrate variations in provisional diagnoses across different locations. The provisional diagnosis of "radiology (no microscopic)" is more prevalent in Damietta, Farskour, and Kafr Saad, while it is lower in El Zarka and Kafr El Batiekh (Abdel-Razek *et al*., 2019). Histology diagnoses exhibit a higher prevalence in Kafr El Batiekh compared to El Zarka (Ahmed *et al*., 2021), and a lower prevalence in Damietta (Salem *et al*., 2020). Additionally, Damietta has fewer laboratory tests/marker studies (Khalifa *et al*., 2022).

It is important to note that our study has some limitations. Firstly, being an observational study, we cannot establish causality between the identified factors and liver cancer prevalence. Future research employing more robust study designs, such as prospective cohorts or case-control studies, would be beneficial in establishing causal relationships. Additionally, our study was conducted within a specific time frame (2021) and focused on the Damietta governate. The generalizability of our findings to other regions or different time periods may be subject to further investigation.

Male patients are more likely to have primary-stage liver cancer and distant metastasis, while female patients are more likely to have localized tumors (Johnson *et al*., 2019). Similarly, the incidence of metastasis is higher in male patients than in female patients (Johnson *et al*., 2019). The findings reveal that the occurrence of localized tumors is higher among male patients compared to female patients, while the presence of distant metastasis is more commonly observed in male patients, and regional involvement is higher exclusively among male patients (Johnson *et al*., 2019). These findings are consistent with previous research that has identified sex-biased molecular signatures for liver cancer survival and differential diagnoses for metastatic carcinoma in the liver (Kim *et al*., 2020; Lee and Park, 2019).

It is important to note that liver cancer is often asymptomatic in its early stages, and most patients present with related symptoms due to chronic liver disease. Therefore, early detection and diagnosis are critical for improving patient outcomes. The sex-based differences in liver cancer stages and tumor sites (Johnson *et al*., 2019). Further research is needed to better understand the underlying factors contributing to these differences and to develop targeted interventions and treatment strategies to improve patient outcomes.

The analysis explores the relationship between these diagnoses and the sex of liver cancer patients (Johnson *et al*., 2019). The results indicate that the

provisional diagnosis of "radiology (no microscopic)" is more frequently assigned to male patients compared to female patients. Histology diagnoses are also more common among male patients. Conversely, the provisional diagnosis based on laboratory test/marker studies is less frequent in male patients (Johnson *et al*., 2019).

The association between the site of the tumor, classified as localized, distant metastasis (Mets), or regional involvement, and the sex of liver cancer patients (Johnson *et al.*, 2019). The findings demonstrate that the occurrence of localized tumors is higher in male patients compared to female patients. Additionally, the presence of distant metastasis is more commonly observed in male patients, while regional involvement is higher exclusively among male patients (Johnson *et al*., 2019).

There are sex-based differences in the prevalence and incidence of liver cancer diagnoses and tumor sites. These findings are consistent with previous research that has identified sex differences in the presentation and prognosis of hepatocellular carcinoma (HCC) (Roy and Chatterjee, 1983; Liu *et al*., 2017; Naugler *et al*., 2007). However, other studies have found no significant sex differences in disease presentation or survival except for older age and lower tumor burden at diagnosis in women (Lai *et al*., 2019; Xue *et al*., 2015).

Early detection and diagnosis are critical for improving patient outcomes. These findings suggest geographical variations in provisional cancer diagnoses among liver cancer patients. Environmental factors, access to healthcare services, and regional differences in diagnostic capabilities may contribute to these discrepancies. Further research is needed to explore the underlying mechanisms and confirm these observations in larger, diverse populations.

CONCLUSION

This study provides valuable insights into the epidemiology of liver cancer in Damietta governorate, Egypt. The findings reveal regional and age-based variations in cancer stages that align with previous research. Certain areas exhibit a higher prevalence of primary liver cancer compared to others, suggesting geographic disparities influenced by local environmental and socioeconomic determinants. Occupational differences in provisional diagnoses were also observed. While associations do not imply causation, these patterns warrant further investigation into underlying occupational exposures or healthcare access issues. A better understanding of such associations could help develop targeted interventions. Sex-based differences in cancer stages and tumor sites were demonstrated consistently with prior literature. However, the influencing factors remain unclear. Further robust research is needed to establish causal relationships and fully elucidate these discrepancies.

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