

Progress on Pathogenesis Rccs and Related Treatments

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Abstract. Kidney cancer has been a concern by society for many years because the pathogenesis of kidney cancer is complex, it may be related to genetic factors, environmental factors and lifestyle. Early diagnosis is crucial for the treatment and prognosis of kidney cancer, but there are still certain challenges. Advances in kidney cancer include gene mutation research, immunotherapy, targeted therapy and liquid biopsy. These research advances are expected to provide more accurate and effective methods for the early diagnosis, treatment and prognosis assessment of kidney cancer. However, the research of kidney cancer still faces some challenges and unknown areas, including early diagnosis, drug resistance mechanism, metastasis mechanism and individualized treatment strategy. This essay is an analysis of the research of kidney cancer, which is about the factors of getting kidney cancer and the treatment of kidney cancer. Kidney cancer research can help improve early diagnosis and screening, gain insight into tumorigenesis mechanisms, overcome drug resistance and metastasis, and promote breakthroughs in immunotherapy. For future expectations, people should refine unclear mechanisms and improve treatment options.

Keywords: RCC; treatments; factors.

1. Introduction

Kidney cancer is the abnormal growth of cells in your kidney tissue. In time, these cells form a mass called a tumor. Cancer begins when something triggers a change in the cells, and they divide out of control. Kidney cancer is the 14th most common cancer worldwide. According to the data from World Cancer Research Fund International, there were 431,288 cases diagnosed in 2020 [1]. According to the American Cancer Society, the relative survival rate for people of all ages and all stages of kidney cancer is 76% [2]. The purpose of researching kidney cancer is to gain a better understanding of kidney cancer, its causes, and risk factors in order to develop more effective methods of diagnosis and treatment. There are 2 main reasons why studying kidney cancer is important. Firstly, studying kidney cancer can improve treatment advancement since research helps to identify new treatment options and improve existing therapies which can lead to better outcomes for patients, including improved survival rates and reduced side effects from treatments. In addition, it can also benefit the early detection of kidney cancer, allowing for earlier diagnosis and intervention.

Previous review articles on kidney cancer focused more on the overview of surgery and treatment methods [3,4]. However, there is a lack of summary of relevant progress in several other aspects of kidney cancer. Because kidney cancer treatment has made significant progress over the years, there is still a need to develop more effective and targeted treatments. Researchers can explore innovative and effective treatments for kidney cancer. The focus of this article is different from other articles in that it will focus more on expectations for future treatments and comparisons with current treatments.

This essay has 3 main sections. The first part is the factor of kidney cancer which has 2 parts which are gene mutations and daily habits. The second section is about nowadays treatment. For instance, immunotherapy, nephrectomy and radiation therapy. This section also will compare and contrast them. The last section is a conclusion, it talks about the conclusion of the drawbacks of this essay and expectations for kidney cancer research.

2. Factor

2.1. Gene Mutation

Genomic studies identify the genes for kidney cancer, including the VHL, MET, FLCN, fumarate hydratase, succinate dehydrogenase, TSC1, TSC2, and TFE3 genes. These studies have significantly altered the ways in which patients with kidney cancer are managed.

The loss of function of the VHL tumor suppressor gene results in the inherited condition known as Von Hippel-Lindau syndrome. Additionally, there is a connection between the occurrence of random clear-cell renal carcinoma and mutations in this gene. The VHL gene produces the pVHL protein, which inhibits and targets hypoxia-inducible factor (HIF) for degradation, hence playing a vital role in tumor suppression. Deviations from normal VHL activity result in the build-up of HIF and the overexpression of angiogenesis-related genes, which in turn stimulate the development of tumors. Renal cell carcinoma therapy may be promising if HIF or its downstream targets, such as vascular endothelial growth factor, are targeted. In kidney cancer clinical trials, a number of medications that target HIF-responsive gene products have demonstrated notable efficacy, representing important advancements in the treatment of this disease [5].

2.2. Page Numbers

2.2.1. Smoking

Smoking is one of the main factors. Medication for renal illness may become less effective due to chemicals in cigarettes. For those who smoke, it is advised to have regular progress reports. In addition to lowering immune function and raising the risk of cancer and kidney infections, smoking exacerbates kidney disease. It can also result in renal disease in people with healthy kidneys by causing further damage to the kidneys. Renal failure is a greater cause of death for smokers than for non-smokers, even in the absence of kidney disease. Smoking damages the kidneys over time, narrows blood vessels and arteries, and decreases blood flow to the kidneys. [6].

In summary, it is important to recognize that tobacco products have impacts, on disease and kidney health. The substances found in tobacco can disrupt the effectiveness of medications used to manage disease necessitating monitoring of progress. Smoking exacerbates kidney disease by compromising function raising the likelihood of infections and cancers and causing harm to the organs. Even individuals with kidneys can develop kidney disease as a result of smoking. Research has shown that smokers without existing kidney disease are more prone to succumb to renal failure compared to non-smokers. The detrimental effects of smoking on kidney health encompass reduced blood flow narrowed arteries and blood vessels and cumulative damage over time. Hence it is crucially important to emphasize the significance of quitting smoking for individuals with existing diseases as well as those, at risk of developing kidney problems.

2.2.2. Obesity

Renal cell carcinoma (RCC) has obesity as a known risk factor. Obesity and RCC have been demonstrated to be positively correlated in several studies. Men are also found to exhibit this relationship, albeit women tend to exhibit it more. Although body mass index (BMI) is the most often used metric to evaluate obesity, other metrics, such as waist circumference and waist-to-hip ratio, also have comparable favorable correlations. It is unclear how exactly obesity affects the formation of RCCs; however, it may be related to growth factors, insulin resistance, and hormonal indicators. The relationship between obesity and RCC survival is more nuanced; some research indicates that there may be a negative correlation at the time of diagnosis. That being said, prejudice or reverse causation might be the cause of this "obesity paradox" as opposed to a true biological association [7].

Recent studies have shown that obesity can affect the surgical management of RCC. Obese patients often have higher rates of surgical complications, longer operative times, and increased blood loss during surgery. These factors can contribute to a lower survival rate of kidney cancer. Overall, the

connection between obesity and RCC highlights the importance of regarding obesity as a risk factor for RCC. Further research is needed to fully understand the mechanisms and implications of this connection in order to develop effective strategies for treatments. By researching obesity, healthcare professionals can potentially reduce the incidence and improve the outcomes of RCC, ultimately benefiting public health.

3. Treatments for RCC

3.1. Immunotherapy

A sort of treatment called immunotherapy makes use of the patient's immune system to aid in the destruction of cancer cells. Patients with metastatic kidney cancer occasionally suffered spontaneous regressions following surgical removal of the main tumor, which was the first clue that kidney cancer would be a potential target for immunotherapy. Because of the possibility of severe adverse effects, immunotherapies—which take the form of immune-stimulating chemicals called cytokines—are now only used as a last resort for advanced kidney malignancies that have not responded to targeted therapies. In roughly 10–20% of patients, kidney tumors decrease as a result of the cytokines interleukin-2 (IL-2) and interferon-alpha. A small percentage of these patients experience lasting remissions [8].

In conclusion, immunotherapy has transformed the treatment paradigm for advanced or metastatic kidney cancer. The development of PD-1/PD-L1 and CTLA-4 inhibitors has revolutionized patient care and brought new hope to those affected by this disease. Further advancements and personalized approaches will continue to improve the effectiveness of immunotherapy which has disadvantage that has obvious complexity and uncertainty. Immunotherapy may also cause severe adverse reactions due to an overactive immune system. More effective and fewer adverse reactions immunological checkpoints are still under further exploration [9], ultimately benefiting kidney cancer patients worldwide.

3.2. Nephrectomy

Nephrectomy is a surgical procedure used for removing either all or a portion of a kidney. Most frequently, it's used to treat kidney cancer or remove a benign tumor. A urologic surgeon is the medical professional who performs the surgery. This method comes in two primary varieties. Whole kidneys are removed during a radical nephrectomy. A partial nephrectomy preserves healthy tissue while removing a portion of the kidney. There are several ways for surgeons to access the kidney. A single incision on the side or in the stomach region can be used for the procedure. We refer to this as an open nephrectomy. The process is most frequently carried out by making several tiny incisions in the stomach region. We refer to this as a laparoscopic nephrectomy. [10]. However, this treatment is not ideal because the amount of kidney is limited since it has to be donated with permission, and the number of patients of kidney cancer is more than the amount of donated lung. To solve this problem, researchers should put a lot of effort into studying how to make artificial kidneys.

3.3. Radiation Therapy

Radiation treatment, otherwise called radiotherapy, is a technique used to obliterate disease cells while limiting harm to solid tissues. For kidney malignant growth, outer shaft radiation treatment (EBRT) is generally utilized, where radiation is designated at the disease from outside the body. On the off chance that the disease has spread external the kidney, stereotactic body radiation treatment (SBRT) might be utilized. The two kinds of radiation treatment can cause transient aftereffects like skin aggravation, weariness, alopecia, and queasiness. Long haul impacts, which can happen a long time to years after therapy, change contingent upon the area treated and the radiation methods utilized. Some conceivable long-haul results of kidney radiation treatment incorporate kidney harm, inside issues, liver harm, spleen harm, skin changes, and an expanded gamble of auxiliary diseases. [11]. It is crucial for patients undergoing radiation therapy for kidney cancer to be aware of these potential

long-term side effects and to work closely with their healthcare team to monitor and manage any complications that may arise. Regular follow-up appointments and screenings are essential to detect and address any long-term complications early on. Despite the potential risks, radiation therapy remains a valuable treatment option for kidney cancer patients. The benefits of effectively targeting and destroying cancer cells often outweigh the potential long-term side effects. It is important for patients to have open discussions with their healthcare providers to weigh the risks and benefits of radiation therapy in their specific case. In conclusion, radiation therapy, specifically EBRT and SBRT, is an effective treatment option for kidney cancer. While there are potential short-term and long-term side effects associated with radiation therapy, the benefits of treating and potentially eradicating cancer cells often outweigh the risks. Through close monitoring and proper management, the long-term side effects can be minimized, allowing patients to achieve a better quality of life after treatment.

4. Conclusion

To conclude this essay, the introduction introduces the basic information of kidney cancer, like what kidney cancer is, diagnosed cases and the survival rate of kidney cancer. Also, the introduction part talks about some review essays that have similar topics. Then is the main body paragraph, it contains two parts which are factors of getting kidney cancer and treatment of kidney cancer. For the factor section, it has two parts, one is the gene mutation such as VHL mutation which plays an important role for getting kidney cancer since it can form tumor in patients' body. Another is daily habits like smoking which can produce tobacco products that affect kidney health and obesity which cause operation complications that decrease the survival rate of patients. The last section of the main body paragraphs talks about different treatments of kidney cancer such as immunotherapy, nephrectomy and radiation therapy. Immunotherapy is a treatment using immune system to kill kidney cancer cell and it has the disadvantage that it has uncertainty. Nephrectomy is a treatment by removing patients' part or all of the kidney but it has a problem that the amount of available kidney is limited. Radiation therapy is a treatment that uses high-energy radiation to destroy cancer cell, but it is not an ideal option to cure kidney cancer because there will be sequelae after using this approach. Furthermore, this analysis prompts us to objectively consider aspects that have not been analyzed. For example, the impact of environmental factors, occupational exposures, and dietary habits on kidney cancer risk remains unexplored. Investigating these areas may provide additional insights into preventive measures and treatment options for kidney cancer. In terms of future research, it is crucial to explore novel therapies and treatment combinations that can improve patient outcomes and minimize side effects. Additionally, studying the genetic and molecular mechanisms underlying kidney cancer can lead to the development of targeted therapies personalized to individual patients. Moreover, conducting large-scale epidemiological studies can provide a better understanding of the risk factors associated with kidney cancer and facilitate the development of preventive strategies. Overall, the analysis of these contents contributes to the existing knowledge on kidney cancer, offering insights into risk factors, treatment options, and areas that require further investigation. This information can serve as a valuable reference for future research endeavors in the field of kidney cancer.

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