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REFINING CLINICAL APPROACHES TO LOCALIZED RENAL CELL CARCINOMA IN PREGNANT PATIENTS: BALANCING CHALLENGES AND INNOVATIONS

УДОСКОНАЛЕННЯ КЛІНІЧНИХ ПІДХОДІВ ДО ЛІКУВАННЯ ЛОКАЛІЗОВАНОГО РАКУ НИРКИ У ВАГІТНИХ: БАЛАНСУВАННЯ ВИКЛИКІВ ТА ІННОВАЦІЙ

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Introduction. Renal cell carcinoma (RCC) during pregnancy is a rare but critical medical challenge, occurring in approximately 1 in 1,000 pregnancies [1, p. 9423]. This condition poses unique clinical and ethical dilemmas, requiring a careful balance between maternal health and fetal safety. Effective management demands a multidisciplinary, patient-centered approach that addresses the physical, psychological, and ethical complexities these patients face.

Early diagnosis of localized RCC is particularly challenging due to its often asymptomatic nature, with overt signs like flank pain or hematuria typically absent. Most cases are identified incidentally during routine prenatal ultrasonography, emphasizing the importance of imaging in early detection. However, when renal masses present with symptoms such as upper urinary tract infections, diagnostic delays and management challenges can arise, further complicating care.

Although routine renal imaging is not currently a standard component of preconception care, individuals with identifiable risk factors – such as obesity, hypertension, family history of cancer, or hereditary syndromes— would benefit from enhanced screening protocols. Early intervention enabled by targeted imaging and genetic testing has the potential to improve outcomes significantly.

The complexities of managing RCC during pregnancy extend beyond diagnosis and treatment. Immediate referral to a multidisciplinary care team is vital to ensure holistic, individualized care. Such teams – comprising oncologists, urologists, obstetricians, hematologists, and psychiatrists – must

also integrate psychological support to address the significant emotional burden carried by these patients. A comprehensive approach that prioritizes the well-being of the mother while carefully considering fetal safety is essential to delivering equitable and effective care.

Parallels Between Cancer and Placental Physiology. RCC and placental development share fascinating biological parallels. Both systems thrive in hypoxic environments, utilizing the hypoxia-inducible factor (HIF) pathway to regulate angiogenesis, immune evasion, and cellular proliferation [2, pp. 8–13]. According to the findings presented in [2], these shared mechanisms provide important insights into both physiological and pathological processes. While these mechanisms are tightly controlled in placental physiology to support fetal development, they become pathological and uncontrolled in RCC.

Understanding these shared pathways provides valuable insights into the behavior of RCC during pregnancy. In our view, this suggests that hormonal and metabolic adaptations, which are crucial for placental function, may inadvertently promote tumor progression. This knowledge underscores the need for innovative therapeutic strategies that consider the unique physiological landscape of pregnancy.

In cases of hereditary RCC syndromes, such as von Hippel-Lindau or hereditary leiomyomatosis, these parallels may be particularly pronounced. Furthermore, systemic therapies, such as immune checkpoint inhibitors and VEGF inhibitors, are contraindicated during pregnancy due to their potential to disrupt placental function and harm fetal development. The focus remains on surgical interventions, with therapeutic adjustments post-pregnancy for high-risk genetic cases.

Hormonal and Metabolic Influences on RCC. Pregnancy-associated RCC is influenced by elevated levels of estrogen and progesterone, which peak during gestation. These hormones stimulate angiogenesis and immune modulation, potentially accelerating tumor growth. Metabolic changes, such as insulin resistance and increased glucose availability, further contribute to a microenvironment conducive to tumor proliferation [3, p. 7246]. Conditions like gestational diabetes, pre-existing diabetes, and lipid disorders should be closely monitored to reduce systemic metabolic stress. Patients with well-managed metabolic conditions tend to experience better postoperative outcomes with fewer complications.

Despite limited large-scale studies, we consider these interventions to represent a promising avenue for improving outcomes in RCC management during pregnancy. In our view, further research into these mechanisms will be essential for refining treatment guidelines and enhancing patient care.

Imaging and Diagnosis. Most RCC cases during pregnancy are identified incidentally via routine prenatal ultrasound. MRI (without gadolinium) provides additional anatomical detail when needed. Challenges in imaging due to anatomical distortions highlight the need for multidisciplinary collaboration and patient counseling about diagnostic limitations. Non-invasive imaging minimizes fetal risks while ensuring oncological safety. Comprehensive imaging strategies tailored to individual patient needs form the cornerstone of effective RCC diagnosis during pregnancy [4, p. 127].

Surgical Timing and Technique. Surgery remains the cornerstone of RCC treatment during pregnancy, balancing maternal health with fetal safety. The second trimester is considered optimal for minimizing miscarriage and preterm labor risks while ensuring effective oncological outcomes. [4]. However, emergent situations, such as rapid tumor progression or severe symptoms, may necessitate earlier intervention.

For tumors ≤3 cm, ablation techniques such as radiofrequency ablation (RFA) or cryoablation provide localized tumor control while preserving kidney function. These methods are particularly advantageous in late pregnancy, where the enlarged uterus complicates traditional surgical access [5, pp. 989–999], [6, p. 520–529].

When tumors exceed 3 cm or are centrally located, ablation techniques often fail to provide adequate oncological control, making partial or radical nephrectomy the preferred approach. Based on our clinical experience, laparoscopic surgery is generally favored due to its association with lower morbidity and faster recovery. However, we recognize that anatomical constraints during pregnancy, particularly for left kidney tumors, can present unique challenges that may necessitate open surgical techniques. In cases involving right kidney tumors, the left lateral decubitus position is typically used to minimize the risk of inferior vena cava (IVC) compression, an important consideration in pregnant patients. However, from our observations, left kidney tumors require additional attention to positioning, as the gravid uterus can complicate surgical access and increase the risk of IVC compression. These challenges underscore the importance of tailoring surgical approaches to the individual anatomical and physiological needs of pregnant patients.

When laparoscopic access is not feasible, open surgery provides a reliable and effective alternative. The patient is positioned supine with a 15–30° tilt to reduce IVC compression, maintaining maternal and fetal hemodynamics. Open approaches ensure oncological efficacy while accommodating pregnancy-related anatomical changes [7, pp. 314–322]. Drawing from our practice, we often employ minimally invasive open techniques, such as upper laparotomy or subcostal access, to minimize tissue

disruption while ensuring optimal surgical outcomes. These approaches allow for adequate exposure of the kidney with smaller incisions, promoting faster recovery and reduced postoperative morbidity.

Postoperative Care and Maternal Risks. Effective postoperative management is crucial to ensuring optimal outcomes for pregnant patients undergoing surgery for renal cell carcinoma. Among the primary concerns is venous thromboembolism (VTE), which is four times more common in pregnant individuals compared to the general population. Prophylactic measures, such as pneumatic compression devices and low molecular weight heparins (LMWH), are critical to reducing this risk.

Pain management is another essential component of care. Paracetamol remains the first-line option due to its safety profile, with short courses of opioids reserved for managing severe pain. For major surgeries, including partial and radical nephrectomies, epidural analgesia offers significant benefits. It minimizes systemic opioid exposure, reduces postoperative pain, and promotes early mobilization, aiding in a smoother recovery process.

Close postoperative monitoring is vital to identify and address potential complications promptly. Surveillance for infections, thromboembolic events, and fetal well-being should be an integral part of the care plan. Multidisciplinary collaboration among obstetricians, oncologists, urologists, anesthesiologists, and other specialists ensures comprehensive and timely care tailored to the unique needs of pregnant patients.

Pre- and postoperative counseling also plays a critical role in addressing patient anxiety and psychological stress. Providing clear and empathetic communication about the recovery process, pain expectations, and potential complications improves adherence to care plans and fosters patient trust and satisfaction [8, pp. 875–899].

Conclusions. The treatment of localized renal cell carcinoma (RCC) during pregnancy presents a rare but significant challenge, requiring a careful balance between maternal health and fetal safety. Despite advancements in diagnostic imaging, minimally invasive techniques, and multidisciplinary care, critical gaps persist in addressing the specific needs of this vulnerable population.

Key priorities include understanding the hormonal and metabolic changes during pregnancy that may accelerate tumor progression and refining imaging modalities to enhance early detection and diagnostic accuracy. Equally important is optimizing postoperative care, with comprehensive protocols that include effective prophylaxis for complications, adequate pain management, and psychological support. These measures are vital to ensuring maternal well-being is prioritized without compromising fetal safety.

Future research must focus on developing innovative, maternal-centered strategies and refining care guidelines to meet the unique challenges faced by pregnant patients with RCC. This work represents not only an opportunity to improve outcomes but also a moral responsibility to address the needs of an underserved population. As oncologists, our commitment to equitable care demands that we provide the same level of attention and innovation to these patients as we do to larger, more represented groups.

Bibliography:

1. Macklin P. S., McAuliffe J., Pugh C. W., Yamamoto A. Hypoxia and HIF pathway in cancer and the placenta. *Placenta*. 2017. Vol. 56. P. 8–13. DOI: 10.1016/j.placenta.2017.03.010.

2. Rysz J., Franczyk B., Ławiński J., Olszewski R., Gluba-Brzózka A. The Role of Metabolic Factors in Renal Cancers. *International Journal of Molecular Sciences.* 2020. Vol. 21. No. 19. P. 7246. DOI: 10.3390/ijms21197246.

3. Zhao Y., Yang Z., Xu W., Ji Z., Dong J. Management of renal tumors during pregnancy: case reports. BMC Nephrology. 2021. Vol. 22. No. 1. P. 127. DOI: 10.1186/s12882-021-02318-w.

4. ACOG Committee Opinion No. 775: Nonobstetric Surgery During Pregnancy. *Obstetrics & Gynecology*. 2019. Vol. 133. No. 4. P. e285. DOI: 10.1097/AOG.0000000000003174.

5. Pierorazio P. M., et al. Management of Renal Masses and Localized Renal Cancer: Systematic Review and Meta-Analysis. *Journal of Urology.* 2016. Vol. 196. No. 4. P. 989–999. DOI: 10.1016/j.juro.2016.04.081.

6. Renal Mass and Localized Renal Cancer: AUA Guideline – PubMed. Accessed Nov. 21, 2024. URL: https://pubmed.ncbi.nlm.nih.gov/28479239/

7. Wolters V., et al. Management of pregnancy in women with cancer. *International Journal of Gynecological Cancer*. 2021. Vol. 31. No. 3. P. 314–322. DOI: 10.1136/ijgc-2020-001776.

8. Black E., et al. Medication Use and Pain Management in Pregnancy: A Critical Review. *Pain Practice*. 2019. Vol. 19. No. 8. P. 875–899. DOI: 10.1111/papr.12814.