



RESEARCH ARTICLE

MANAGING LOCALLY ADVANCED CERVICAL CARCINOMA WITH A PELVIC KIDNEY USING VOLUMETRIC MODULATED ARC THERAPY: A CLINICAL CHALLENGE

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Abstract

The coexistence of cervical carcinoma and pelvic kidney is uncommon. Given that the pelvic kidney occupies the traditional radiation field for cervical carcinoma, treating these patients with radiation poses a therapeutic dilemma. We report the case of a 72 years old patient with stage IIIB cervical carcinoma with an incidental diagnosis of pelvic kidney was treated with radical chemoradiotherapy using volumetric-modulated arc therapy with concurrent weekly cisplatin.. At the 12-month follow-up, the patient was disease free and had no deterioration in kidney function. Volumetric-modulated arc therapy (VMAT) allowed for the precise delivery of high radiation doses in this particular case, while effectively sparing the kidney.

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Introduction:-

Cervical cancer represents a public health problem worldwide; it is the fourth most frequently diagnosed cancer and the fourth leading cause of cancer death in women, with 604,127 new cases per year and 341,831 deaths[1]. The standard of treatment of locally advanced cervical cancer is concurrent chemoradiation and brachytherapy.[2]

The incidence of pelvic kidney varies worldwide with an approximation of between 1 in 2200 and 1 in 3000 births[3]. The simultaneous occurrence of cervical carcinoma and an ectopic pelvic kidney is a rare phenomenon. It presents a therapeutic challenge in the management of locally advanced cervical carcinoma as the kidneys have a low tolerance for radiation.[4, 5]

Normally, The location of the kidney is outside the standard radiation fields for cervical cancer, but a pelvic kidney is at risk of radiation injury and nephritis.[6, 7]

The subtle balance between therapeutic efficacy and potential side effects can be effectively adjusted by employing modern radiation techniques to their fullest potential.

We report a case of stage IIIB (2018 International Federation of Gynecology and Obstetrics) carcinoma of the cervix with ectopic pelvic kidney, which was treated with radiation therapy using volumetric-modulated arc therapy (VMAT) with concomitant chemotherapy.

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Case Report

We report the case of a 72-year-old postmenopausal patient who presented with moderate metrorrhagia. There was no history of postcoital bleeding, abdominal pain, or urinary or bowel complaints. Following consultation, a biopsy was performed, confirming squamous cell carcinoma of the cervix. An Magnetic Resonance Imaging (MRI) revealed a cervical-isthmic tumor measuring 40x17x51mm, which breached the fibrous arch and infiltrated the proximal parametria. It invaded the lower third of the vagina, reached the posterior wall of the bladder and urethra with loss of fat plane without signs of invasion, and came into intimate contact with the anterior wall of the mid-rectum with loss of fat plane without signs of infiltration. Additionally, a right pelvic kidney was present, classifying the process as stage IIIB according to the 2018 FIGO staging (Figure 1-2). A contrast-enhanced thoraco-abdominal-pelvic CT scan showed a cervical-isthmic tumor without iliac or para-aortic lymphadenopathy and no distant metastases. A cystoscopy and a rectoscopy were performed and returned normal results. A renal scintigraphy was also conducted, showing a functional right kidney at 34% and a left kidney at 66%. The renal assessment was normal without any anomalies.

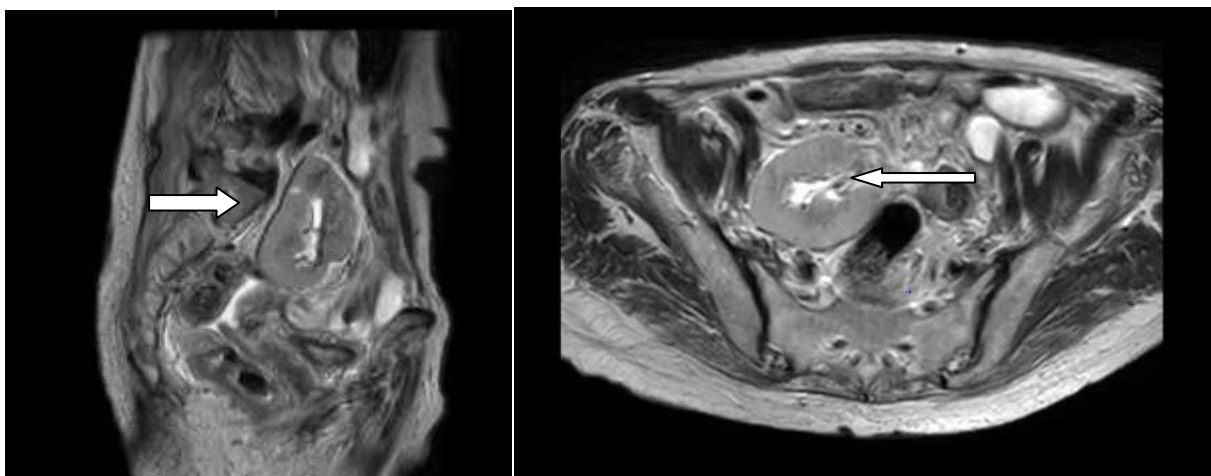


Figure 1:- Magnetic Resonance Imaging images (Sagittal and axial) in T2 sequence showing the pelvic kidney

Clinical examination revealed a 4 × 5 cm ulcerated and proliferative tumor involving all walls of the vagina. Rectal examination found smooth and mobile rectal mucosa, and the two parametria were thickened up to the lateral pelvic wall.

A planning CECT of the abdomen and pelvis with intravenous contrast was obtained.

The planning CECT images were acquired using the MONACO treatment planning system and targets, including organs at risk (OARs), were contoured. The total delivered dose was 66 Gy. A first course of 46 Gy on the pelvis (the cervix, entire vagina, uterus, bilateral parametria and pelvic lymph nodes), a second course of 20 Gy administered to the residual tumor while the OARs included both kidneys, bladder, rectum, femur heads and the bowel.

Planning was performed using the MONACO treatment planning system. A VMAT plan with 2 arcs and dose of 46 Gy in 23 fractions with 2Gy per fraction was prescribed on the first course to which one has been added 20 Gy also 2Gy per fraction. The target planning constraints used were as follows: PTV should receive between 95 and 107% of the prescribed dose. The planning constraints for normal tissues were as follows: small bowel: V40 < 200 cc; rectum: V60 < 50 %; bladder: V60 < 50 %; and bilateral kidney: mean dose (Dmean) < 18 Gy and femoral heads V50 < 20%. There was adequate coverage of the target, with 95% of the PTV receiving 44.012 Gy for the first course (Figure 3-4) and 63.74 Gy for the second course and the mean dose to the bilateral kidney was 16.37, all the other constraints were respected.

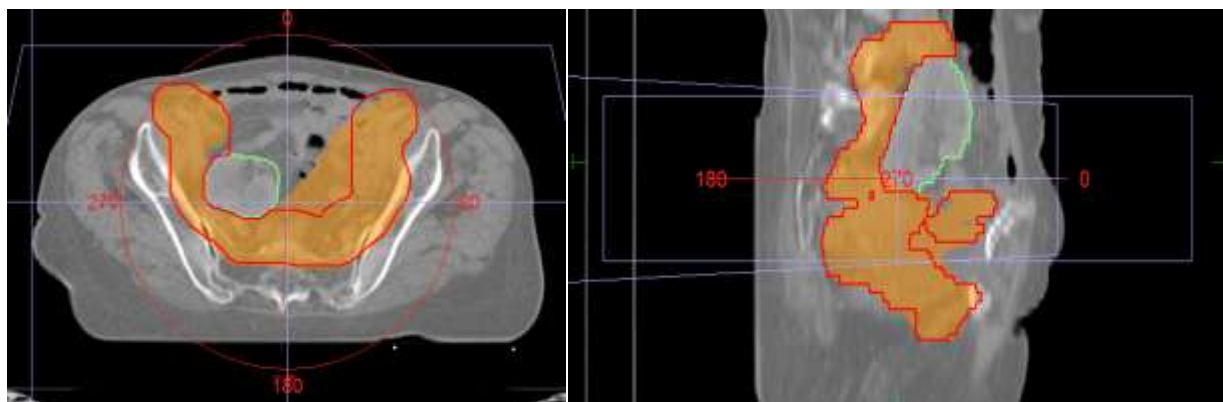


Figure 2:- The dose distribution of the VMAT plan with coverage of the target volume at 95% of the prescription dose of 46Gy (43.7Gy) while sparing the pelvic kidney (axial and sagittal view).

The patient completed pelvic radiation with four weekly cycles of concurrent cisplatin with 2 episodes of anemia. She developed grade 1 skin, genitourinary and gastrointestinal toxicity as per Common Terminology Criteria for Adverse Events version 4.0.8. During treatment, there was no deterioration in kidney function.

The overall treatment duration was 7 weeks.

The patient was last seen at the 12-month follow-up. She was disease free with normal renal function.

Discussion:-

A pelvic kidney is a congenital anomaly where one or both kidneys are located in the pelvic area instead of their normal position in the abdomen. It occurs due to a developmental abnormality during fetal development.

The coexistence of an ectopic kidney and locally advanced cervical carcinoma is rare and presents a therapeutic challenge for management due to the presence of a pelvic kidney adjacent to the draining lymph nodes .

Before initiating therapy, it is essential to assess renal function thoroughly. Utilizing evidence-based treatment strategies is crucial to maximize the potential for cure.

Surgery is preferred over radiotherapy in early stages of cervical carcinoma with pelvic kidney to avoid radiation-induced damage to the pelvic kidney and better regional nodal management[8]

For locally advanced stages, radiochemotherapy remains the optimal choice. The challenge in treating the patient arises from the risk of compromising the function of the ectopic pelvic kidney located within the radiation field. This is attributed to the limited tolerance of the kidney to radiation, which is influenced by the volume of tissue receiving radiation. The accepted tolerance dose of radiation for the entire kidney is 20 Gy, and the risk of radiation-induced damage to the kidney can be minimized by ensuring that the radiation dose delivered to the entire kidney remains below 20 Gy .[9]

Tolerance dose for a 5% chance of late adverse effect at 5 years is estimated to be 50 Gy for one third of the kidney, 30 Gy for two thirds, and 23 Gy for the whole kidney. It increases to 50% late toxicity if two thirds are irradiated to a dose of 40 Gy or whole kidney to a dose of 28 Gy [8]

The constraints for kidney given by Quantitative Analyses of Normal Tissue Effects in the Clinic are V12<55% and V20<32% and mean dose 18. In our case the bilateral kidney received a mean dose of 16.37

Radiation nephropathy can manifest in acute or chronic form, as benign or malignant hypertension or as hyperreninemic hypertension secondary to scarred kidney (Goldblatt kidney). These clinical syndromes may overlap in presentation. There is usually a six to 12 month latency period before clinical expression of acute radiation nephropathy.[10]

For the technique of radiation, conventional radiotherapy techniques have been reported for the treatment of cervical carcinoma with pelvic kidney. However, prior instances have led to either sacrificing the pelvic kidney or the occurrence of recurrence in shielded regions.[11, 12]

This highlights the necessity of employing modern radiation techniques, such as IMRT, for the management of these entity.

Surgical intervention to move the pelvic kidney out of the radiation portal has also been attempted. Auto transplantation of the ectopic kidney is complicated by a short ureter and vascular anomalies[13]

For the first time in 2006, Castilho et al. have reported treatment of adjuvant IMRT for an endometrial cancer patient with a centrally located pelvic kidney at the level of the sacroiliac joints. Seven coplanar fields were used in their IMRT technique which covered 95% of the whole pelvis and lymphatics to 45 Gy. The patient suffered no recurrence or side effects to either kidney at 18 months.[14]

Several cases have been reported subsequently, demonstrating the benefit of IMRT either after surgery[15] or as exclusive therapy in combination with concomitant chemotherapy[9, 10]

On follow-up, one patient experienced relapse outside the radiation portal, which was managed with surgery and adjuvant chemotherapy[15], one was disease free after a 18 18-month follow-up [10] and the last one reported a disease-free survival of 2 years with normal clinical examination, renal function tests, and imaging [9]. For our case The patient was disease free with normal renal function after the 12-month follow-up.

Conclusion:-

Treating cervical carcinoma alongside a pelvic kidney presents a considerable therapeutic challenge. Surgical interventions should be considered for early-stage disease (stage I-IIA), while curative radiation therapy, especially advanced techniques for better preservation of the pelvic kidney without compromising the prescribed dose to the target, such as IMRT or VMAT, can be administered for locally advanced disease. Patients should undergo regular monitoring for disease recurrence and potential decline in renal function.s

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