ORIGINAL RESEARCH

Evaluation of reduction in tumor volume on pre brachytherapy MRI Scan in patients of Carcinoma cervix

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ABSTRACT
Background: Cervical cancer is the fourth most common malignancy diagnosed in women worldwide and second most common malignant tumor in women in India. Hence; the present study was conducted for evaluating reduction in tumor volume on pre brachytherapy MRI Scan in patients of Carcinoma cervix. **Materials & methods:** A total of 50 patients with carcinoma of cervix were enrolled.Inclusion criteria included patients receiving curative treatment with external beam radiotherapy along with concurrent chemotherapy followed by intracavitary or interstitial radiotherapy. Pre-and post EBRT imaging information was collected and tumor reduction volume reduction rate and residual tumor volume was calculated. **Results:** Data of a total of 50 patients was analysed during the study period. Mean age of the patients was 49.5 years. Progressive diseases were encountered in 2 percent of the patients.Mean pre-external beam radiotherapy volume (V1) and mean post-external beam radiotherapy volume (V2) was found to be 45.3 cc and 8.7 cc respectively. Overall Tumor volume reduction rate was found to be 80.79 %. Overall survival and locoregional failure free survival was found to be 68.13 months and 67.81 months respectively. **Conclusion:** Pre-brachytherapy MRI may assist in identifying appropriate candidates for brachytherapy and ensuring the administration of the prescribed doses to the tumor.
Key words: Brachytherapy, Magnetic resonance imaging, Cervix carcinoma

INTRODUCTION

Cervical cancer is the fourth most common malignancy diagnosed in women worldwide and second most common malignant tumor in women in India. Globally majority of cases of cervical cancer result from infection with the human papillomavirus (HPV), with HPV DNA identified in approximately 95% of malignant cervical lesions.[1, 2]Choice of treatment depends on the FIGO stage of the disease, which should be assessed accurately. FIGO staging assessment is done on the basis of clinical examination findings (including bimanual examination per vaginum, per speculum examination and examination under anaesthesia) and radiological findings.[3, 4]MR imaging is widely accepted as the one of the best modalities for detection of primary tumor and local spread of cervical cancer. In recent studies Tumor volume reduction rate (TVRR) is now emerging as prognostic tool in carcinoma cervix patients. It is defined as the percentage of TV reduced on the Post EBRT MRI scan relative to the pre-EBRT MRI scan; done prior to brachytherapy. TVRR acts as a marker for assessment of treatment response to EBRT.[4, 5] Hence; the present study was conducted for evaluating reduction in tumor volume on pre brachytherapy MRI Scan in patients of Carcinoma cervix.

MATERIALS & METHODS

The present study was conducted forevaluating reduction in tumor volume on pre brachytherapy MRI Scan in patients of Carcinoma cervix. Inclusion

criteria included patients receiving curative treatment with external beam radiotherapy along with concurrent chemotherapy followed by intracavitary or interstitial radiotherapy. A total of 50 patients with carcinoma of cervix were enrolled. Pre-and post EBRT imaging information was collected and tumor reduction volume reduction rate and residual tumor volume was calculated. The SPSS software was used for the statistical analysis.

RESULTS

Data of a total of 50 patients was analysed during the study period. Mean age of the patients was 49.5 years. Squamous cell carcinoma and adenocarcinoma was the histological diagnosis in 70 percent and 20 percent of the patients respectively.Complete response was seen as post primary treatment response in 80 percent of the patients while partial response was seen in 10 percent of the patients. Progressive diseases were encountered in 2 percent of the patients.Mean pre-external beam radiotherapy volume (V1) and mean post-external beam radiotherapy volume (V2) was found to be 45.3 cc and 8.7 cc respectively. Overall Tumor volume reduction rate was found to be 80.79 %. Overall survival and locoregional failure free survival was found to be 68.13 months and 67.81 months respectively.

Table 1: Distribution of subjects according to histology

Histology	Number	Percentage
Squamous cell carcinoma	35	70
Adenocarcinoma	10	20
Others	5	10
Total	50	100

Table 2: Distribution of patients according to Cancer directed treatment

Cancer directed treatment	Number	Percentage
Radical chemo-radiotherapy	44	88
Only radiotherapy	6	12
Total	50	100

Table 3: Distribution of patients according to Post primary treatment response (3 months)

Post primary treatment response (3 months)	Number	Percentage
Complete response	40	80
Partial Response	5	10
Not done	4	8
Progressive disease	1	2
Total	50	100

Table 4: Tumor volume reduction rate

Variable	Mean	SD
Pre- External beam radiotherapy volume (V1) (cc)	45.3	23.9
Post- External beam radiotherapy volume (V2) (cc)	8.7	18.7
Tumor volume reduction rate [(V1-V2)/ V1] (%)	80.79	39.8

Table 5: Survival

Variable	Mean	SD
Overall survival (Months)	69.2	23.8
Locoregional failure free survival (Months)	66.9	26.7

DISCUSSION

Cervical cancer rates have significantly decreased in areas where screening initiatives are in place. Currently, approximately 70 percent of the cervical cancer burden is concentrated in low-socioeconomic regions where such screening programs are inadequately implemented. In 2018, there were around 569,847 new cases and 311,365 deaths attributed to cervical cancer, making it the fourth leading cause of cancer-related mortality among women. Notably, about 84% of cervical cancer cases arise from low socio-economic areas. This trend can be largely attributed to the introduction of PAP smear testing and HPV vaccination in developed nations, which have collectively led to a 75% reduction in both incidence and mortality over the past 50 years. Conversely, in developing countries, cervical cancer remains the second most prevalent cancer and the third leading cause of cancer deaths among women. In the United States, cervical cancer ranks third in both incidence and mortality among gynecological cancers.[6-9]Hence; the present study was conducted for evaluating reduction in tumor volume on pre

brachytherapy MRI Scan in patients of Carcinoma cervix.

In the present study, data of a total of 50 patients was analysed during the study period. Mean age of the patients was 49.5 years. Squamous cell carcinoma and adenocarcinoma was the histological diagnosis in 70 percent and 20 percent of the patients respectively.Complete response was seen as post primary treatment response in 80 percent of the patients while partial response was seen in 10 percent of the patients. Progressive diseases were encountered in 2 percent of the patients.Mean pre-external beam radiotherapy volume (V1) and mean post-external beam radiotherapy volume (V2) was found to be 45.3 cc and 8.7 cc respectively. Overall Tumor volume reduction rate was found to be 80.79 %. Overall survival and locoregional failure free survival was found to be 68.13 months and 67.81 months respectively.Murofushi K et al retrospectively evaluated patients with cervical cancer who underwent pre-brachytherapy MRI within 7 days before their first high-dose rate brachytherapy treatment. A total of 146 patients were included in the study. The median tumor sizes were 52 mm (range 17-85) at the pre-treatment MRI and 30 mm (range 0-78) at the pre-brachytherapy MRI. Multivariate analysis showed that tumor characteristics (size, shape, and extent of invasion) were not risk factors, although inappropriate brachytherapy was significantly related to poor local control.[10]Petric P et al assessed feasibility and efficacy of MRI-assisted pre-planning, based on applicator insertion in para-cervical anaesthesia (PCA).Five days prior to BT, the pre-planning procedure was performed in 18 cervix cancer patients: tandem-ring applicator was inserted under PCA, pelvic MRI obtained and applicator removed. Procedure tolerability was assessed. High risk clinical target volume (HR CTV) and organs at risk were delineated on the pre-planning MRI, virtual needles placed at optimal positions, and dose planning performed. Pre-planning procedure was well tolerated. Median difference between the pre-planned and actual needle insertion depth and position were 2 (0–10) mm and 4 (0–30) degrees, respectively. The differences between the pre-planned and actual geometric and dosimetric parameters were statistically non-significant. All actual needles were positioned inside the HR CTV and outside the organs at risk (OAR). Their pre-planning approach was well tolerated and effective. Pre-planned geometry and dose distribution can be reproduced at BT.[11]

CONCLUSION

Pre-brachytherapy MRI may assist in identifying appropriate candidates for brachytherapy and ensuring the administration of the prescribed doses to the tumor.

REFERENCES

1. Melnikow J, Henderson JT, Burda BU, Senger CA, Durbin S, Weyrich MS. Screening for Cervical Cancer With High-Risk Human Papillomavirus Testing: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA. 2018 Aug 21;320(7):687-705.
2. Egemen D, Cheung LC, Chen X, Demarco M, Perkins RB, Kinney W, Poitras N, Befano B, Locke A, Guido RS, Wiser AL, Gage JC, Katki HA, Wentzensen N, Castle PE, Schiffman M, Lorey TS. Risk Estimates Supporting the 2019 ASCCP Risk-Based Management Consensus Guidelines. J Low Genit Tract Dis. 2020 Apr;24(2):132-143.
3. Cheung LC, Egemen D, Chen X, Katki HA, Demarco M, Wiser AL, Perkins RB, Guido RS, Wentzensen N, Schiffman M. 2019 ASCCP Risk-Based Management Consensus Guidelines: Methods for Risk Estimation, Recommended Management, and Validation. J Low Genit Tract Dis. 2020 Apr;24(2):90-101.
4. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018 Nov;68(6):394-424.
5. Petignat P, Faltin DL, Bruchim I, Tramèr MR, Franco EL, Coutlée F. Are self-collected samples comparable to physician-collected cervical specimens for human papillomavirus DNA testing? A systematic review and meta-analysis. Gynecol Oncol. 2007 May;105(2):530-5.
6. Safaeian M, Kiddugavu M, Gravitt PE, Ssekasanvu J, Murokora D, Sklar M, Serwadda D, Wawer MJ, Shah KV, Gray R. Comparability of self-collected vaginal swabs and physician-collected cervical swabs for detection of human papillomavirus infections in Rakai, Uganda. Sex Transm Dis. 2007 Jul;34(7):429-36
7. Denny L, Herrero R, Levin C, Kim JJ. Cervical Cancer. In: Gelband H, Jha P, Sankaranarayanan R, Horton S, editors. Cancer: Disease Control Priorities, Third Edition (Volume 3). The International Bank for Reconstruction and Development / The World Bank; Washington (DC): Nov 01, 2015.
8. Herbert A, Holdsworth G, Kubba A. Why young women should be screened for cervical cancer: the distinction between CIN2 and CIN3. Int J Cancer. 2010 May 01;126(9):2256-7; author reply 2257-8.
9. Beavis AL, Gravitt PE, Rositch AF. Hysterectomy-corrected cervical cancer mortality rates reveal a larger racial disparity in the United States. Cancer. 2017 May 15;123(6):1044-1050.
10. Murofushi K, Yoshioka Y, Sumi M, Ishikawa H, Oguchi M, Sakurai H. Outcomes analysis of pre-brachytherapy MRI in patients with locally advanced cervical cancer. Int J Gynecol Cancer. 2020 Apr;30(4):473-479
11. Petric P, Hudej R, Hanuna O, Marolt P, Al-Hammadi NM, Riyas MP, Segedin B. MRI-assisted cervix cancer brachytherapy pre-planning, based on application in paracervical anaesthesia: final report. Radiol Oncol. 2014 Jul 10;48(3):293-300