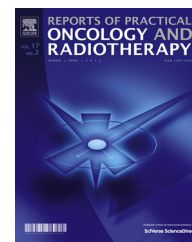


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Original research article

Outcome of radiotherapy for pituitary adenomas



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ABSTRACT

Aim: The aim of this study was to analyze the outcome and toxicities and its correlation to patient related and treatment related factors.

Background: Pituitary adenomas are treated by radiation therapy (RT) as one of the modalities along with surgery and medical therapy. RT to pituitary adenomas is a challenge due to adjacent dose limiting structures such as optic apparatus and hypothalamus.

Materials and methods: Between January 2004 and December 2010, 94 patients treated for pituitary adenoma with RT who had hospital records of a minimum follow-up of 1 year were included in the analysis. Tests of correlation were done with regards to treatment factors.

Results: Male preponderance was noted in our patient population. Nonfunctioning and functioning tumors were equal in number in this series. Hypopituitarism was associated in 58.5% of patients prior to RT. Radiological tumor progression was seen in one patient (1/94) who had a nonfunctioning tumor. Among functioning tumors, biochemical remission was seen in 93.6% of patients at a median follow-up of 6 years.

Conclusions: Visual complication was seen in 5.3% of patients and worsening or new onset hypopituitarism was seen in 6.4%. Conventional 3-field technique was associated with significantly more visual complication compared to Stereotactic Radiation Therapy (SRT) technique. Doses ≤ 50.4 Gy showed a trend of reduced rate of visual and endocrine complications with no compromise in efficacy.

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Abbreviations: RT, radiation therapy; CT, computerized tomography; MRI, magnetic resonance imaging; GH, growth hormone; ACTH, adrenocorticotropic hormone; FSH, follicle-stimulating hormone; MV, megavoltage; SRT, stereotactic radiotherapy; 3DCRT, 3 dimensional conformal radiotherapy; GTC, Gill Thomas Cosman; SPSS, Statistical Package for the Social Sciences; CR, complete response; SD, stable disease; PR, partial response; Gy, Gray; cGy, centiGray; SRS, stereotactic radiosurgery; FSRT, fractionated stereotactic radiotherapy.

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1. Background

Pituitary adenomas constitute 10% of all intracranial neoplasms.¹ These slow growing tumors arise from the anterior pituitary and are commonly benign.² They are either nonfunctioning or functioning (secretory) tumors. Although surgery is the mainstay of treatment for nonfunctioning and non-prolactin secreting pituitary adenomas, radiation therapy (RT) is required for residual or recurrent lesions, for few inoperable circumstances or when other modalities fail.³ Proximity of these tumors to the optic apparatus and hypothalamus increases the risk of developing post-surgical and post radio therapeutic complications, such as hypopituitarism and visual deterioration.

2. Aim

We aimed to analyze the outcome, treatment related toxicities and its correlation to patient related and treatment related factors in patients with pituitary adenomas who received RT.

3. Materials and methods

One hundred and seventeen patients were diagnosed to have pituitary adenoma and received radiotherapy between January 2004 and December 2010. Of the 117 patients, 94 who had hospital records of a minimum follow-up of 1 year were included for retrospective analysis. All patients had a histological diagnosis of pituitary adenoma and CT/MRI scan for follow-up imaging. The patient factors, tumor factors, radiotherapy treatment details, duration of follow-up, the radiological and biochemical response, and the side effects, such as new onset or worsening hypopituitarism, visual deterioration were noted from hospital records. Functioning tumors were those which secreted hormones into the bloodstream. Those tumors stained positive for hormone but not secreting ones were classified under nonfunctioning tumors. Partial or panhypopituitarism, whether present prior to RT, was noted. Tests of correlation were done with regards to treatment factors, such as total radiation dose and dose per fraction.

As shown in Table 1, the median age of our study population was 41 years and age ranged from 14 to 71 years and 60.6% were males. Functioning and nonfunctioning tumors were equal in number (50% each) and among functioning tumors, 46.8% were growth hormone (GH) secreting and 23.5% were ACTH secreting tumors. Majority (91.5%) of the tumors were macroadenomas (>1 cm). Histopathologically, 10.6% of them were atypical and none were malignant. Partial or panhypopituitarism was found in 58.5% at diagnosis. The percentage of patients who had more than 1 surgery was 18.1%.

As shown in Table 2, the indication for RT was residual postoperatively for 66%, progression (either biochemical or radiological) for 26.6% and surgery not possible for 7.4%. Radiation dose prescribed was 45–50 Gy in nonfunctioning tumors and 50–55.8 Gy in functioning tumors. Radiation dose was prescribed to the isodose that covered the target volume in 56.3% of the patients and, therefore, the 100% isodose total dose was

Table 1 – Patient characteristics.

Characteristics	No. of patients (%) N = 94
Age (median [range]) (years)	41 (14–71)
Sex	
Male	57 (60.6)
Female	37 (39.4)
Hormone secretory	
Non secretory (non functioning)	47 (50)
Secretory (functioning)	47 (50)
Growth hormone	22 (46.8)
Prolactin	6 (12.7)
FSH ^a	4 (8.5)
ACTH ^b	11 (23.5)
>1 hormone	4 (8.5)
Size	
Macroadenoma	86 (91.5)
Microadenoma	8 (8.5)
Histology	
Benign	84 (89.4)
Atypical	10 (10.6)
Malignant	0 (0)
Hypopituitarism at diagnosis	
Present	55 (58.5)
Absent	39 (41.5)
Prior surgeries	
0 surgery	6 (6.4)
1 surgery	71 (75.6)
2 surgeries	15 (15.9)
3 surgeries	2 (2.1)

^a Follicle-stimulating hormone.

^b Adrenocorticotrophic hormone.

Table 2 – Radiotherapy details.

Radiotherapy details (n = 94)	
Timing of radiation	
Adjuvant (after surgery)	62 (66)
Recurrent (at progression)	25 (26.6)
Radical (surgery not feasible)	7 (7.4)
Dose of RT ^a (100% isodose dose)	
4500–5040 cGy	13 (13.8)
5041–5400 cGy	41 (43.6)
>5400 cGy	40 (42.6)
Dose per fraction (cGy) (100% isodose dose)	
180	19 (20.2)
181–200	69 (73.4)
>200	6 (6.4)
Technique of RT ^a	
Stereotactic radiotherapy	63 (67)
No of non-coplanar beams range (4–14)	
3-dimensional conformal radiotherapy (2 lateral and 1 vertex coplanar beams)	5 (5.3)
Conventional (3 fields – 23; 2 fields 3)	26 (27.7)
Beam energy	
6 MV ^b	90 (95.7)
15 MV ^b	2 (2.1)
Cobalt 60	2 (2.1)

^a Radiation therapy (RT).

^b Megavoltage.

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