Safety and Efficacy of Fractionated Stereotactic Radiation Therapy for Pituitary Adenomas

Aveline Marie Ylanan[1,2], Alan Nichol[1,3], Roy Ma[1,3], Michael McKenzie[1,3], Fred Hsu[1,2], Shiekh Nisar Ahmed[1,2], Ryojo Akagami[1], Peter Gooderham[1], Michelle Johnson[1], Ermias Gete[1,3], Arthur Cheung[1,4], Isabelle Vallieres[1,5], Justin Oh[1,3], Waseem Sharieff[1,2]

[1]University of British Columbia, Vancouver, BC, Canada, [2]BC Cancer, Abbotsford, BC, Canada, [3]BC Cancer, Vancouver, BC, Canada, [4]BC Cancer, Surrey, BC, Canada, [5]BC Cancer, Victoria, BC, Canada

Introduction

Pituitary tumors are on the rise. **Fractionated stereotactic radiation therapy** (FSRT) is a treatment option for well-differentiated **pituitary neuroendocrine tumors (PitNETs),** formerly known as pituitary adenomas. Previous studies were limited by a relatively short follow-up. Considering the non-malignant nature of the tumors and the expected normal lifespan of patients, we aimed to describe **long-term outcomes** on **safety and efficacy** of FSRT for these tumors.

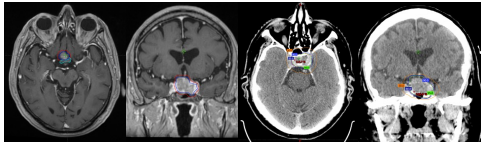
Methods

Case series of patients treated with FSRT for well-differentiated pituitary tumors from 1998-2021 in British Columbia.

Indications for FSRT: inoperable cases, gross residual disease after surgery, or after failure of surgery and maximal medical management in case of secretory tumors.

50.4 Gy in 28 fractions

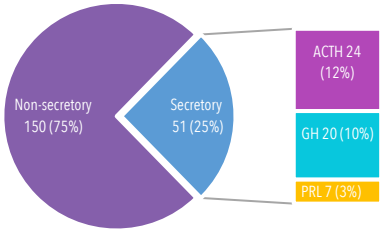
GTV tumor seen on co-registered CT & MRI
CTV GTV and the operative bed
PTV isotropic 2-mm expansion of the CTV



Co-registered planning CT and T1 gadolinum-enhanced planning images of a representative patient who received FSRT. From left-right, T1 MRI with gadolinium enhancement in axial and coronal planes shows the GTV in blue, PTV in red, and chiasm in cyan. CT simulation images shows the isodose lines as follows: 95% in green, 90% in blue, 80% in dark blue, and 50% in orange. The PTV in red is covered by the 95% isodose line in axial and coronal planes.

Results

1786 diagnosed ▸ **224** treated with RT ▸ **203** had FSRT ▸ **1** lost to follow-up immediately after FSRT ▸ **201** included



Median follow-up: **11.6 years**

196 (97.5%) had surgery
Median # of surgeries **1 (0-5)**
Time from surgery to radiation of > 6 months **174 (88.8%)**

PreRT vision intact **123 (61.2%)**
PreRT vision intact **123 (61.2%)**

Median volume (cc): CTV:5.5, PTV 10.9

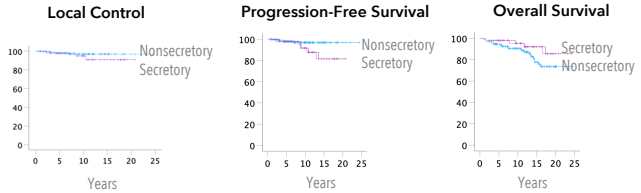
LOCAL CONTROL (LC) *at 10 years* Absence of growth on follow-up imaging	**Non-secretory** 97%	**Secretory** 91%

BIOCHEMICAL RESPONSE	**ACTH**	**GH**	**PRL**	**Overall**
Complete response normalization of hormone levels w/o suppressive medications	34.8%	10.5%	33.3%	25.0%
Objective hormonal response CR or decrease of hormone levels to <50% of baseline w/o suppressive medications	34.8%	10.5%	50.0%	27.1%
Biochemical control OHR or normalization of hormone levels with or w/o suppressive medications	52.2%	57.9%	83.3%	58.3%
Biochemical progression >20% hormone level and/or the subsequent need for antihormonal treatment	13.0%	0	0	6.3%

PROGRESSION-FREE SURVIVAL (PFS) *at 10 years* Completion of FSRT to either radiologic or biochemical progression	**Non-secretory** 97%	**Secretory** 91%
OVERALL SURVIVAL (OS) *at 10 years* Completion of FSRT to death from any cause	**Non-secretory** 90%	**Secretory** 95%

Median PFS and OS were not reached.
Analysis revealed better PFS with: time from surgery of > 6 months and volume of PTV > 7 cc.

Kaplan Meier Curves for nonsecretory and secretory groups



TOXICITIES

Hypopituitarism
56 (27.8%)

Deterioration of vision
4 (2.0%)

Stroke
2 (1.0%)

Secondary malignancies
7 (3.0%)

Key Findings

- This study with an **extensive long-term follow-up and sizable patient population** showed **good LC and PFS**, consistent with previous reports.
- **Biochemical response did not exceed rates reported in other studies**. This might be explained by variations in response criteria, differences among protocols on tapering of suppressive medications, and use of crude rates with varying follow-up times among the studies. It would be worthwhile to explore dose escalation and cessation of suppressive medications in future studies.
- **Hypopituitarism was the most common toxicity**. Fewer patients developed hypopituitarism than what would be expected with conventional techniques. **Other side effects were rare.**