EFFECTS OF CYBERKNIFE RADIOTHERAPY TREATMENT OF PITUITARY ADENOMAS

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INTRODUCTION

- CyberKnife (CK), a LINAC-based robotic device for frameless stereotactic surgery is an emerging treatment for pituitary tumours (PT) resistant to other therapies.

PATIENTS AND METHODS

- We report long-term CK effect on endocrine function and tumour volume in 20 PT patients (10M/10F, mean age 57.52 13.97 yrs).
- Twelve patients harbored a non functioning adenoma (NFPA), 2 an ACTH, 5 a GH (1 case of TSH co-secretion) and one a PRL-secreting PT.
- Before CK 9 patients had normal while 11 presented an impaired pituitary function (4 cases of isolated pituitary deficiency, 5 multiple pituitary deficiencies and 2 panhypopituitary, **Fig. 1**).
- Patients were treated using conventional CK (Cyber-Knife®, Accuray, Inc., Sunnyvale, CA) multisession radiosurgery schemes (1–5 fractions); mean volume of the treated lesions was of 8.87 11.3 cc; mean marginal dose was 21 4.9 Gy, mean prescription isodose line 72.95 5.3% and mean coverage 96.1 1.37%.
- CK was used as first line treatment in 3 cases (2 NFPA and 1 GH/TSH secreting adenoma) and for treating residual pituitary tumours in the other 17 cases.
- The mean follow-up period was 24.17 20.53 months (range 3-112 months).

RESULTS

- MRI : demonstrated tumour shrinkage in 55% of patients: in 3 NFPA cases tumour was no longer visible (1 case of first line treatment) while 8 cases presented significant tumour shrinkage (6 NFPA patients, 1 GH and 1 ACTH secreting PT). In 6 cases no volumetric variations were registered; tumour increase was evident only in 3 cases: 1 NFPA, 1 aggressive GH and one aggressive PRL secreting PT (**Fig. 2**).
- Pituitary function impairment occurred in 4 of the 9 patients with previous normal pituitary function who developed isolated deficiency in 2 cases and multiple deficiencies in the other 2.
- Among 6 patients with previously multiple or isolated hypopituitarism, 5 became panhypopituitary and 1 developed a new deficit (**Fig. 3**).
- One acromegaly patient, previously resistant to medical treatment normalized IGF-I levels.

Fig. 1 Pre-CK Pituitary Function

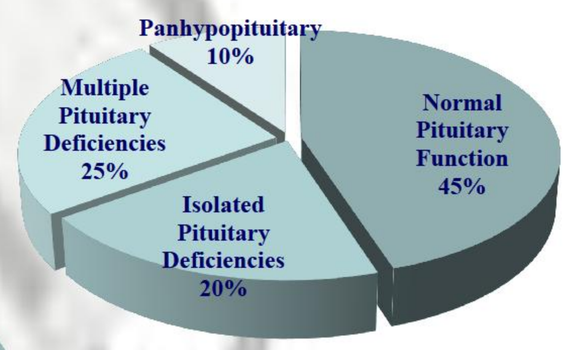
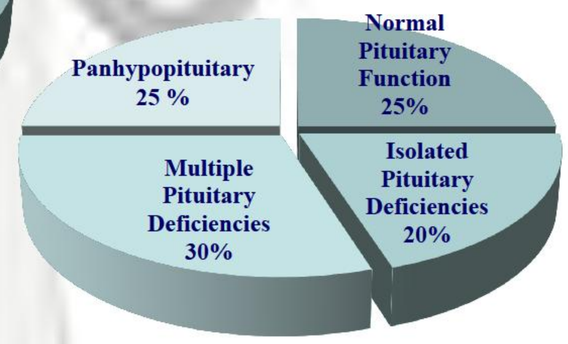


Fig. 2 Post-CK Tumour Volume Variations

Fig. 3 Post-CK Pituitary Function



Patient	Age (yrs)	Gender	Tumour Type	Tumour Size	Neurosurgery	Indication for CK treatment	Marginal Dose/ Fractioning (Gy/fr)	Isodose (%)	Coverage (%)	Pre-CK Pituitary Function Impairment	Post-CK Pituitary Function Impairment	Pre-CK Tumour volume (cc)	Post-CK Tumour Volume Variations	Follow-up (months)
1	56	M	NFPA	Macro	NO	↑ Ø + ASA 4	22/4	84	96	NO	GH	1.35	↓*	112
2	46	F	NFPA	Macro	TNS	↑ Ø	16/1	68	98	TSH-GH-LH/FSH	PANHYPOPITUITARY	4	↓	52
3	42	F	NFPA	Macro	TNS (2)	↑ Ø	15/1	60	99	TSH-GH	PANHYPOPITUITARY	2.8	↓*	41
4	79	F	NFPA	Macro	TNS	↑ Ø	21/3	80	97	TSH-GH-LH/FSH	PANHYPOPITUITARY	3.4	↓	20
5	57	M	NFPA	Macro	TNS	↑ Ø	17/1	73	96	TSH-GH-LH/FSH	PANHYPOPITUITARY	1.5	↓	40
6	43	F	NFPA	Macro	TNS (3)	↑ Ø	27.5/5	71	96	NO	NO	4.1	↓	3
7	69	M	NFPA	Macro	TNS	↑ Ø	27.5/5	80	95	GH	GH-LH/FSH	4,9	↔	5
8	75	M	NFPA	Macro	NO	↑ Ø + ASA 4	16/1	75	96	NO	GH	2.1	↓	13
9	51	F	NFPA	Macro	TNS	↑ Ø	17/1	78	97	NO	TSH-GH-LH/FSH	2	↔	72
10	54	F	NFPA	Macro	TNS	↑ Ø	16.5/1	68	97	NO	NO	0.52	↓*	9
11	75	F	NFPA	Macro	TNS	↑ Ø	24/5	70	95	NO	GH-LH/FSH	0.89	↓	17
12	69	F	NFPA	Macro	TNS	↑ Ø	24/4	68	96	LH/FSH	LH/FSH	5.82	↑	10
13	36	M	GH	Macro	TNS	SSa+PEG Resistance	20/1	78	94	LH/FSH	LH/FSH	0.18	↔	8
14	59	F	GH	Macro	TNS	SSa+PEG Resistance	16/1	80	96	NO	NO	1.8	↔	45
15	65	M	GH/TSH	Macro	NO	SSa e PEG Intolerance + ASA 4	16/1	70	96	NO	NO	0.26	↔	24
16	49	M	PRL	Macro	TNS	↑ Ø + CAB Resistance	23/5	68	97	GH	PANHYPOPITUITARY	31.8	↑	49
17	75	F	GH	Macro	TNS	SSa+PEG Resistance	24/3	75	97	NO	NO	23.8	↓	18
18	49	M	ACTH	Macro	TNS, CT	↑ Ø	30/5	75	93	TSH-GH-LH/FSH	TSH-GH-LH/FSH	22	↔	22
19	35	M	ACTH	Macro	TNS	↑ Ø	27.5/5	74	96	GH-LH/FSH	GH-LH/FSH	27.5	↓	6
20	65	M	GH	Macro	TNS (2)	↑ Ø	25/5	75	95	TSH-LH/FSH-ACTH	TSH-LH/FSH-ACTH	29.2	↑	3

Table 1: TNS trans-naso-sfenoidal, CT transcranial, SSa somatostatin analogs, CAB cabergoline, PEG Pegvisomant, ↑ increase, ↓ decrease, ↔ stable, * 100% tumour shrinkage

CONCLUSIONS

- CK treatment for PT is safe and effective, ceasing tumour growth in 85%, and inducing tumour shrinkage in 55% of cases. Nevertheless, impairment of pituitary secretion was demonstrated in 44% of cases with previously intact pituitary function and in 55% of already hypopituitary patients. Moreover, CK treatment was able to obtain disease control of resistant acromeglay.

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Endocrine tumours

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