Pituitary radiotherapy

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Pituitary radiotherapy is generally regarded as treatment to be used in patients not responding completely to surgery and medical therapy, although it has also been used to minimize the need for long-term medical treatment. While generally quite effective, radiotherapy requires a long timeline to achieve therapeutic goals, often taking many years for hormone normalization when given for hormone-secreting tumors. However, its effects on tumor growth may be more immediate, such that it may prevent tumor growth (or regrowth) within months after being given, although tumor shrinkage may again be a slower process occurring over several years. Because of this slowness of response, the relatively high efficacy of medical and surgical treatments for the various types of pituitary tumors, and the adverse effects of radiotherapy, it is rarely used as primary treatment.

The techniques of radiotherapy have evolved over recent years with an overall improvement in the benefit/risk profile. Fewer patients now receive conventional external beam radiotherapy, which involves the use of two or three ports to concentrate a radiation beam on the pituitary fossa by a crossfire technique and is delivered in daily doses given 4–5 days per week over a period of 5–6 weeks, up to a total dose of 4,500–5,000 cGy. This technique may still be used for patients with a considerable volume of tumor to be treated. Most advances over conventional treatment use

stereotactic techniques to shape the radiation beams to conform to the shape of the tumor, thereby reducing radiation exposure to surrounding normal brain. Stereotactic conformal radiotherapy is also a fractionated form of radiotherapy, but is delivered with a linear accelerator (LINAC), which generates photon beams. While the use of limited daily fractions (<200 cGy) and such carefully controlled three-dimensional radiation architecture has greatly diminished the possibility of radiation-induced damage to normal tissues, including the optic pathways, there still remains concern about generalized changes to the surrounding vasculature. More recently, single dose stereotactic radiotherapy has become widely available and is being increasingly used. Most single dose radiotherapy uses cobalt-60 gamma radiation emitting sources (Gamma Knife[®] radiotherapy) arranged in a hemisphere to focus on a central target, in this case the pituitary tumor. A LINAC-based system has also been modified to deliver a single dose. There is no clear advantage for either of these single dose techniques (Gamma Knife vs. LINAC) in terms of their ability to spare normal tissue from high radiation doses. Heavy-charge particle proton beams have also been used but their use is very limited, as few centers have the facilities to provide this form of radiotherapy, due to its high operational and maintenance costs.

The ability to tightly focus the radiation to a small area makes any of these stereotactic techniques excellent choices for treating residual tumor following surgery. Although the optic apparatus is very radiation sensitive, the cranial nerves coursing through the cavernous sinus are relatively radio resistant; therefore, the stereotactic single dose techniques are particularly useful for residual tumor in the cavernous sinus. As of yet, there are no adequate studies to conclude whether there is one mode of single-dose radiotherapy that has superior efficacy or safety, and indeed

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direct comparisons of single-dose vs. fractionated stereotactic radiotherapy are all but non-existent.

In this issue of *Pituitary*, papers focus on the benefits and risks of the various types of radiotherapy for particular tumor types. These authors have carefully detailed both the risks and benefits of treatment. In addition, the specific risks of increased mortality and hypopituitarism have been

explored in detail in separate papers. The Editors of this volume anticipate that readers will find this information current and useful in helping choose appropriate candidates for this therapeutic modality, which still occupies an important place in the therapeutic armamentarium of the clinical neuroendocrinologist.