Spatially-Fractionated Grid Therapy and its Implications for Radiation Oncology

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Objective

- To evaluate the technique of grid therapy and how it can improve the field of radiation therapy
Origins of grid therapy date back to the orthovoltage era\textsuperscript{3-7}
Created as a way to treat deep-seated tumors while sparing skin\textsuperscript{3}
A block with a grid design was attached to the head of the treatment machine\textsuperscript{3}
With the invention of megavoltage machines, grid therapy became obsolete\textsuperscript{5,6}
Recently, it has been reestablished in some treatment facilities for treating large tumors\textsuperscript{2,5,6}
Grid block made of lead or cerrobend is attached to the accessory mount of a linear accelerator\textsuperscript{1,6}

Contains holes that are 1-2 cm apart and 0.5-1 cm wide\textsuperscript{1,6}

Half the field gets irradiated, half is blocked by the grid\textsuperscript{6}

Figure 1. A megavoltage grid block attached to a linear accelerator for treatment.\textsuperscript{6}
What is it?

- Used with photon energies of 6-20 MV$^{2,5}$
- Can be used with a variety of field sizes$^{2,5}$
- 1 fraction of 10-20 Gy$^{8,9}$
- Ideal for treating large, bulky tumors which have been unresponsive to other forms of treatment$^3$
Biological Mechanisms

- Creates the effect of having many small pencil beams$^{2,5}$
- “Peaks and valleys” in dose distribution allow for irradiation with very high doses$^{3,5}$
- Possible due to the cellular bystander effect$^{5,6,9,10}$
  - Tumor cells which were not directly irradiated but were near cells that were, also die$^{5,6,9}$
  - Healthy cells in shielded areas act as repair centers for surrounding normal tissue$^1$
  - Seems to occur in situations where stress is placed on a cell$^9$
71 patients with tumors >8 cm in size received grid therapy\(^2\)

63 were treated for palliative purposes\(^2\)

Most common sites: lung or head/neck\(^2\)

Overall response rate was 75\(^\%\)\(^2\)

Complete response in 16\(^\%\) of patients\(^2\)
Clinical Results

- 79 patients received grid therapy in addition to EBRT
- Overall response rate was 75%
- Minimal toxicities
- Achieved a higher level of tumor kill than open field radiation therapy

Figure 3. Clinical response of a patient with a fungating tumor on her right breast who received grid therapy. The patient is shown at the time of treatment (a) and four months after treatment (b).
Advantages

- Has resulted in regression of tumors which have been otherwise unresponsive\(^1\)
- Large doses can be delivered without increasing toxicities\(^1\)
- Inexpensive and reusable\(^1\)
  - Grid can be mounted onto any linear accelerator and can be used for multiple patients
- Setup and treatment planning is relatively simple\(^1\)
- Given in a single fraction\(^8\)
Disadvantages

- Biological mechanisms are mainly hypotheses\(^8\)
- Small movements by patient may significantly change dose distribution\(^5\)
- Longer overall treatment time
Grid therapy is not ideal for every case, but may be beneficial for eligible patients.

A possible option for palliative treatments.

Has shown to be especially effective on head and neck cancers.

Clinical studies demonstrate rapid tumor response.

Single fraction treatments and lower toxicities are beneficial for patients.
References


