Precise Brain Tumor Volume Determinations Using a Personal Computer

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ABSTRACT

Introduction:

Oncologists determine brain tumor growth visually by measuring 3D tumors by the slice.
Even in research settings, tumor volumes are often determined by measuring the greatest
length by width by depth determined by the tumor in question. Often, for tumor
measurements and analyses, and often without recognizing, especially when applied to irregular volumes (e.g. wallflowers).

Although some semi-automated systems are available, these are for radiography or ion-therapy guided—these impose strict shapes and size constraints. Therefore, we wanted to develop a system for precisely determining brain tumor volumes on a PC with this determined directly from the scanner vendor's "Patient Access Communication System" (PACS - General Electric).

Methods:

Brain tumor volume determinations were made using the
Analyze™ PC 3.8 Biomedical Imaging Software (AnalyzeDirect, LLC) and an eissueDVR (Medical Imaging PC, or "MED")
Windows 95 operating system. The method was applied to animal and human tumors for comparison to 3D volumes with
radiographic and histopathologic data - the "animal and human"
radiographic images were easily used. To obtain absolute accuracy, these techniques btnded in using the software-developed
"slice" images. Animal tumor volumes were determined directly, after metrics.

Results:

Over a range of tumor volumes, the mean standard deviation (r =
0.02) between the human and animal volumes was about 3.0% 
(± 0.02%). Analytical tumor volume determination was significantly
superior compared to manual measurement. Efficient data entry
was performed without excessive time, and the resulting images
occasionally required phospholipids. Volumes could be displayed
in order to visualize the volume of the animal tumors.

Conclusions:

This semi-automated technique can be performed by technicians
with high inter-observer variability. It should be extremely
valuable for clinical trials, for use in determining the response
to therapy, or tumor progression.

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RESULTS

1. Analyze™ software package can be used to
precisely calculate brain tumor volumes in both
animal and patients. Tumors that can be
studied include not only those with
simple geometric shapes, but also ones with
complex configurations, such as in recurrent
glioblastoma.

2. Volumetric determinations can be done either
an automated fashion, or "semi-automated" in
which the region of interest is manually traced.
The procedure can be performed by laboratory
(or MRI) technicians after a brief training
session.

3. Reproducibility studies in animal models have
shown low inter-observer variability.

CONCLUSIONS

1. The Analyze™ PC Biomedical Imaging
Software is relatively inexpensive and
simple to use. More clinical testing of this
product is needed.

2. In the future, use of such software in
clinical trials should allow for a more
accurate assessment of response to therapy.