Role of stereotactic biopsy in multifocal brain lesions: considerations on 100 consecutive cases

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Abstract

One hundred patients affected by multifocal brain lesions were investigated by serial stereotactic biopsy. Systemic diseases and primary neoplasms elsewhere were previously ruled out. The histological diagnosis obtained in this series comprises malignant gliomas in 37% of patients; primary non-Hodgkin's brain lymphoma in 15%; metastatic brain tumours in 15% (no evidence of the primary tumour at the time of stereotactic surgery); low grade gliomas in 12%; infective diseases in 10% (including brain abscesses and multifocal viral encephalitis); and ischaemic lesions in 6%. In addition, two patients with germinomas, two with primitive neuroepithelial tumours, two with multiple telangiectases, and one with a teratoma were also included in this series. Histological findings obtained by stereotactic procedures guided the choice of treatment, avoiding the risks of blind treatments. Indications and future perspectives for stereotactic surgery in multifocal brain lesions are discussed with emphasis on advances in diagnostic and therapeutic tools.

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The use of CT and MRI allows the pattern of multiple brain lesions to be determined in patients with a neurological focal deficit or with symptoms of intracranial hypertension.

Most of these patients could be diagnosed correctly regarding the nature of their intracranial lesions after clinical and laboratory findings as in multiple sclerosis, in secondary infective and parasitic diseases, in metastatic tumours, and in the brain localisations of systemic diseases. Nevertheless, in some cases the multiple lesions detected by CT and MRI remain the only demonstrable evidence of the illness and treatment may be planned only on the presumptive diagnosis.

The usefulness of stereotactic procedures to detect the nature of the lesions and decide treatment is discussed based on our experience of 100 consecutive patients operated on at the National Neurological Institute of Milan.

Materials and methods

Between 1978 and 1991 940 patients underwent stereotactic serial biopsy for brain lesions. One hundred patients out of these series were affected by multiple intracerebral lesions. They were selected for stereotactic biopsy based on the following criteria:

1. They had no neoplasms outside the nervous system.
2. They had no systemic diseases possibly related to the brain localisations.
3. There were no disorders of the cerebral circulation and no evidence of demyelinating diseases of the nervous system.
4. They had a CT and MRI pattern suggesting different aetiologies in regard to the nature of the lesions.
5. Neurological and general conditions still allowed a therapeutic choice (Karnofsky stage >70).

The ages of these cases ranged from 7 to 66 (mean age 51); 67 were caucasian males. The heralding symptoms included intracranial hypertension in 60 cases, focal neurological deficits in 26 cases, and epileptic seizures in 14 cases. Only in two patients the clinical picture suggested the presence of multiple focal lesions before neuroradiological examinations. Until 1985 the radiological diagnosis was achieved by CT and then by CT and MRI. The number of radiologically demonstrated lesions ranged from two to eight (mean four) in each patient. In 85 patients the lesions were only supratentorial whereas in the other cases the cerebellum and the brainstem were also involved. In 75 cases lesions were localised on both sides. Preliminary corticosteroid treatment (4 mg dexamethasone thrice daily) was performed in all cases to treat intracranial hypertension and oedema around the lesion, and to rule out primary brain lymphoma.

The stereotactic biopsy was performed with different frames including Riechert, BRW, CRW, Zeppelin, and Leksell systems and since 1986 was assisted by three dimensional computerised reconstruction of CT or MRI images. All tissue specimens were obtained with a Nashold biopsy instrument. Intraoperative smear examinations were performed by methylene blue staining. Two cases with worsening of pre-existing hemiparesis due to a small bleed within the basal ganglia targets were considered to have permanent morbidity. There was no operative mortality in this series.

Results

Thirty seven patients had malignant multifocal gliomas including anaplastic astro-
958
enhanced
MRI
for
The
only
complained
male
patient.
and
the
multifocal
leucoencephalitis
cytarabine.

40
stereotactic
weighted
axial
of
patient
treated
by
biopsy
stereotactic
gliomas
Low
non-Hodgkin's
Primary
Metastatic
encephalitis
Viral
1
primitive
glioblastomas;
(27
bacterial
Primary
Progressive
multifocal
glioma
and
In
biopsy
evolution
tological
seven
cases
poorly
I
histological
adenocarcinomas
suggesting
two
history
progressive
patients
multifocal
expanding
procedure
displayed
plasias
2
patients
Six
complained
the
five
multifocal
lesions
as
neuroepithelial
tumours
and
the
multifocal
gliomatosis
as
suggested
the
similar
five
cases,
and
the
five
patients
affected
by
single
malignant
non-operated
gliomas.

Multiple
primary
brain
lymphomas
were
treated
by
chemotherapy
with
methotrexate,
vincristine,
and
carmustine
and
external
radiotherapy;
the
survival
ranged
between
16
months
and
five
years
(mean
three
years).

Metastatic
tumours
were
treated
by
external
brain
radiotherapy
only
(6000
rads).
These
patients
were
also
investigated
for
the
primary
tumours
outside
the
nervous
system.
The
origin
of
brain
metastatic
tumours
was
found
in
only
two
cases
out
of
14.
Survival
ranged
between
five
and
24
(mean
seven)
months.

Germinomas
were
treated
by
radiotherapy;
complete
clinical
and
radiological
recovery
was
obtained
in
one
case
(four
years
follow
up)
whereas
in
the
other
patient
early
dissemina-
tion
occurred
with
fatal
recurrence
of
the
disease
despite
the
similar
histological
findings.

Multifocal
primitive
neuroepithelial
tumours
were
treated
as
malignant
gliomas,
with
poor
results.
The
patient
affected
by
multiple
ter-
atomas
underwent
chemotherapy
with
platinex,
vepesis,
and
bleomicine,
and
ex-
ternal
radiotherapy
to
the
whole
brain
and
spinal
axis
with
radiological
reduction
of
the
lesions;
this
patient
is
still
disease
free
at
a
three
year
follow
up.

Patients
with
multiple
strokes
were
given
pharmacological
treatment
with
ticlopidine
after
ruling
out
microembolic
peripheral
sources
in
the
heart
and
supra-ortic
vessels.

One
patient
with
gliovascular
haemorrhagic
dysplasias
died
within
one
year
after
the
biopsy
due
to
lesion
rebleeding;
the
second
patient
is
still
alive
but
has
complained
of
pro-
gressive
worsening
without
major
haemor-
rhage.

Patients
with
multiple
primary
cerebral
abscesses
were
treated
by
stereotactic
aspira-
tion
of
major
lesions
and
repeated
intra-
cavitory
and
systemic
antibiotic
treatment.

All
patients
recovered
and
are
still
doing
well
at
three
to
eight
year
follow
up.
Patients
with
multifocal
viral
encephalitis
and
by
prin-
tive
neuroepithelial
tumours
had
fatal
out-
comes
within
four
months
of
stereotactic
biopsy.

Figures
1–7
show
neuroradiological
patterns.
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Figure 2  T1 weighted gadolinium enhanced axial MRI for a 57 year old patient. The patient complained of drowsiness and quadriparesis. Stereotactic biopsy demonstrated non-Hodgkin's lymphoma and the patient underwent external radiotherapy.

Figure 5  Proton density axial MRI for a 35 year old female patient. The patient complained of headache without focal deficits. Stereotactic biopsy showed a viral multifocal encephalitis and the patient was treated with acyclovir.

Figure 3  Contrast enhanced CT of a 62 year old male patient. The patient complained of right hemiparesis and aphasia. Stereotactic biopsy disclosed non-Hodgkin's lymphoma and the patient was treated with radiotherapy and chemotherapy (methotrexate, vincristine, and carmustine).

Figure 6  T1 weighted gadolinium enhanced axial MRI for a 67 year old female patient. The patient complained of headache, vomiting, and mild right hemiparesis. Stereotactic biopsy demonstrated an anaplastic astrocytoma and the patient underwent chemotherapy (cis-platin, carmustine, etoposide) and conventional radiotherapy.

Figure 4  Contrast enhanced CT of a 67 year old male patient. The patient complained of mild left hemiparesis. Stereotactic biopsy demonstrated metastatic tumours and the patient underwent external radiotherapy.

Figure 7  Contrast enhanced CT on a 30 year old male patient. The patient complained of headache and vomiting without focal deficits. Stereotactic biopsy disclosed a pyogenic abscess and the patient was given specific intracavitary and systemic antibiotic treatment.

The patient complained of female patient. The patient complained of headache without drowsiness and quadriparesis. Stereotactic biopsy showed a viral multifocal encephalitis and the patient was treated with acyclovir.

The patient complained of right hemiparesis and aphasia. Stereotactic biopsy disclosed non-Hodgkin's lymphoma and the patient was treated with radiotherapy and chemotherapy (methotrexate, vincristine, and carmustine).

The patient complained of headache, vomiting, and mild right hemiparesis. Stereotactic biopsy demonstrated an anaplastic astrocytoma and the patient underwent chemotherapy (cis-platin, carmustine, etoposide) and conventional radiotherapy.

The patient complained of mild left hemiparesis. Stereotactic biopsy demonstrated metastatic tumours and the patient underwent external radiotherapy.

The patient complained of headache and vomiting without focal deficits. Stereotactic biopsy disclosed a pyogenic abscess and the patient was given specific intracavitary and systemic antibiotic treatment.
Discussion
The diverse range of diseases in this series of patients emphasises the importance of histological diagnosis to avoid the hazards of treatments based only on clinical and neuro-radiological data. The stereotactic biopsy can achieve this goal with low morbidity and zero mortality.

The following points need be taken into consideration. Most non-neoplastic lesions could have been missed because of the clinical and radiological patterns resembling malignant tumours; catastrophic brain damage inflicted by blind radiotherapy and chemotherapy was avoided.

In two patients the diagnosis of AIDS was established after histological findings of brain lesions progressive multifocal leucoencephalitis before the appearance of serological evidence of the disease.

In patients affected by neoplasms the correct histological diagnosis contributed to the evaluation of life expectancy—that is, in brain lymphomas and malignant gliomas.

In the near future, the extensive utilisation of stereotactic radiosurgery and combined surgical and radiosurgical treatment of multiple metastatic tumours will considerably boost the need of preoperative histological diagnosis in multifocal brain lesions.

In conclusion, stereotactic biopsy may be considered the first step in the treatment of multiple brain lesions when the selection criteria that characterise the reported series of patients are fulfilled.

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