Hypersexuality or altered sexual preference following brain injury

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SUMMARY Eight patients are described in whom either hypersexuality (four cases) or change in sexual preference (four cases) occurred following brain injury. In this series disinhibition of sexual activity and hypersexuality followed medial basal-frontal or diencephalic injury. This contrasted with the patients demonstrating altered sexual preference whose injuries involved limbic system structures. In some patients altered sexual behaviour may be the presenting or dominant feature of brain injury.

Hypersexual behaviour and alteration in sexual preference has been produced by experimental brain injury in animals but appear to be unusual consequences of focal brain injuries in humans.2–4 When such alterations occur, they offer meaningful insights into the anatomy and physiology underlying normal sexual behaviour and provide important evidence regarding the neurological basis of aberrant sexual behaviour. This study describes eight patients in whom sexual activity was either increased or changed following a focal brain injury. The relevant literature is briefly reviewed and clinico-pathologic correlations made.

Case histories

Hypersexuality

Case 1 A 39-year-old right-handed businessman was admitted to the hospital following sudden collapse. Two weeks prior to admission he had the acute onset of a frontal headache associated with nuchal rigidity. The evening of his hospital admission he walked to the bathroom in his home and fell to the floor. Seconds later his wife found him repetitively saying his own name. He was brought to hospital awake and alert but his verbal output was sparse. In the hospital, he publicly masturbated and attempted to have intercourse with his wife and with female nurses in front of his three roommates. Mental status examination on admission revealed a withdrawn and apathetic male. He answered many questions with curses but had normal digit span, constructions and language. He did not know the date and remembered none of three words after 3 minutes. Funduscopic examination revealed papilloedema and both legs were weak and spastic with bilateral Babinski signs.

A computed tomographic scan (CT) showed a basal-frontal haemorrhage and angiography revealed an aneurysm of the anterior communicating artery. He became extremely drowsy within 24 hours and slowly slipped into coma. Despite aggressive medical and surgical management he died 2 weeks after admission to hospital. Necropsy showed haemorrhage in the basal frontal areas bilaterally with involvement of the septal region.

Case 2 A 59-year-old right-handed man was admitted to a psychiatric hospital in a floridly hypersexual state. Two years previously he had a grand mal seizure and at that time CT scan revealed a subfrontal meningioma. The tumour was removed transcallosally without complication. After surgery his desire for sexual activity increased from once per week to at least once and sometimes 3 to 4 times per day. Intercourse frequently lasted longer than 1 hour and he had some difficulty achieving orgasm. Over the next 9 months his excessive sexual demands led to the end of a close relationship with a girlfriend of many years.

Two years after his surgery he became increasingly preoccupied with sex and developed a manic syndrome. He was admitted to hospital where he publicly masturbated and sexually propositioned both male and female patients and staff (he had a past history of previous homosexual contacts). In hospital his behaviour was ameliorated with thiopentine and benztporne. Mental status examination revealed decreased generation of word lists (eight animals named in 1 minute) and mild difficulty with verbal memory (one of three words remembered after 3 minutes). The basic neurological exam-
Cachectic
openly
sexual
and
entire
a
leaving
superior cerebellar artery aneurysm.

Intense
was
in
following
one
him
during
ictal
behavioural
sexually
became
Case
intercourse
of
he
that
he
litis
the sound of
generalisation. He

troencephalograms
left temporal
complex partial seizures
oped
3 At age
Case
month. In addition

temporary
sharp
became
these
never
he
approached her

He
were
2
more

A

event

His wife
complained
that
he
never
approached her
sexually, and their
frequency of
intercourse dropped from
2
to
3
times
per
week
to
1
or
2
times
per
year. In
the
postictal
period,
however,
the
patient
became
sexually
aroused. His
wife
became
aware
of
his
post-
ictal
behavioural
change
and
sought
sexual
relations
with
him
during
these
periods. The
arousal
lasted
less
than
10
minutes
and
the
patient
was
amnesic
for
the
encounters.
Following
one
prolonged
complex
partial
seizure
the
patient
felt
intense
sexual
arousal
lasting
12
hours.

Case
4
A
31-year-old
woman
developed
a
severe
headache
and
was
admitted
to
hospital
where
a
CT
scan revealed
blood
in
the
basilar
cisterns
and
angiography
showed
a
right
superior
cerebellar
artery
aneurysm.
The
aneurysm
was
sur-
gically
clipped
but
5
days
after
operation
she
had
a
stroke
leaving
a
left-sided
motor
and
sensory
deficit,
and
a
behav-

ioral
change.

Previously
a
shy
person,
she
began
to
talk
incessantly
about
sexual
matters
and
propositioned
her
physicians. She
developed
a
sexual
preoccupation
with
her
internist
and
discussed
openly
in
explicit
sexual
language
with
him,
and
others,
hers
for
him.
She
propositioned
only
males,
and
on
one
occasion
she
requested
intercourse
with
a
cachectic
70-year-old
patient
dying
of
cancer. While
in
hos-

ital,
she
described
intense
sexual
excitement,
and
in
retro-

spect
she
remembers
feeling
"warm"
and
"aroused"
almost
the
entire
month. In
addition

to
the
sexual
excitement,
she
had
increased
appetite,
disturbed
sleep,
and
a
verbal
output
that
approached
flight
of
ideas.

Mental
status
examination
revealed
normal
attention
with
intact
language,
memory,
and
calculation. Her
writing
was
very
small
and
she
had
difficulty
copying
3-dimensional
drawings.
She
had
a
left
homonymous
hemianopsia,
a
mild
left
hemiparesis,
and
a
dense
left
hemisensory
deficit
including

diminished
sensitivity
to
pain
and
temperature.
CT
scan
(fig
2)
demonstrated
a
lucency
in
the
right
thalamus
and
hypothalamic
regions.
She
gradually
recovered
and
the
heightened
sexual
sensation
disappeared
after
1
month.

Change
in
sexual
orientation
Case
5
A
50-year-old
man
was
hospitalised
in
1981
by
his
wife
in
an
effort
to
control
his
pathological
sexual
behaviour.
They
had
been
married
for
30
years.
For
the
first
15
years
of
the
marriage
they
had
a
mutually
satisfying
relationship
with
sexual
intercourse
approximately
5
times
per
week.
At
the
age
of
34
the
patient
developed
subtle
changes
in
personality
and
displayed
poor
financial
judge-

ment.
During
the
same
year
he
lost
his
business,
developed
increasing
difficulty
with
erection
and
ejaculation,
began
to
make
sexual
proposals
towards
his
7-year-old
daughter
and
her
friends,
and
also
began
collecting
pornography.
After
losing
his
business
in
1968,
he
worked
for
approximately
7
more
years
at
a
job
far
below
the
level
of
his
previous
employment.
He
eventually
developed
urinary
incontinence
and
in
1975
a
diagnosis
of
"idiopathic"
hydrocephalus
was
made.
A
ventriculo-atrial
shunt
was
inserted,
and
the
incon-
tinence
disappeared.
At
the
same
time
it
was
noted
that
he
was
hypothyroid
and
he
was
treated
for
this
condition.

He
maintained
an
aberrant
interest
in
sexual
matters.
He
made
frequent
and
increasingly
more
public
sexual
advances

towards
young
children
and
his
conversation
was
filled
with
sexual
innuendo.
He
frequently
embarrassed
his
wife
by
showing
pornographic
pictures
to
visitors
at
their
home.
IQ

testing
in
1977
revealed
a
verbal
IQ
of
105
and
a
per-

formance
IQ
of
106.
Endocrine
testing
suggested
 hypo-

Fig
1
CT
scan
(Case
2)
demonstrates
bilateral
basal-frontal
infarction
in
a
patient
with
a
hypersexual
syndrome
following
removal
of
a
subfrontal
meningioma.
increase in sexually motivated activity was apparent after he regained consciousness from his encephalitis. He made sexual comments toward females he encountered in the hospital and attempted to fondle the nurses. He masturbated publicly. After discovery of the hydrocephalus and shunt placement, his sexual behaviour became “disgusting” according to his wife. He became “the man with a thousand hands” attempting to fondle her each time she came within reach. He requested intercourse with her frequently and also asked that she have sex with other men while he watched, an interest never previously expressed.

On examination he was alert and language, memory and calculation were intact. He could name only six animals in 1 minute and he could not abstractly interpret proverbs or copy complex constructions. Neurological examination was normal except for mild psychomotor retardation. A CT scan revealed hydrocephalus with the tip of the shunt inserted into midline anterior hypothalamic-inferior septal structures. Cisternography was consistent with normal pressure hydrocephalus but the patient refused shunt revision.

Case 7 A right-handed woman was well until age 31 years when she developed progressive lethargy, somnolence and confusion followed by a generalised seizure. She became comatose and had frequent generalised seizures. Cerebrospinal fluid (CSF) examination revealed lymphocytosis, normal glucose and an elevated CSF protein. Fungal and bacteriologic studies of serum and CSF were normal and an EEG showed generalised slowing with left-sided focal spike and slow wave activity. A presumptive diagnosis of herpes simplex encephalitis was made.

She gradually improved but manifested an aphasia with incoherent repetitive and irrelevant verbal output consisting mainly of neologic jargon. Learning was severely impaired and she could not remember recent or remote events. She was emotionally indifferent. Sexual behaviour changed: she showed no interest in intercourse with her husband although she complied with his advances. She made both oral and manual sexual advances to female attendants in the hospital.
She gained 50 pounds and ate food and nonfood items, including toilet paper and faeces. There was little improvement or change in her behaviour over 13 years.

**Case 8**  A 71-year-old man developed Parkinson's disease at age 61 manifested initially by micrographia. Slowness, rigidity, and tremor were apparent within 2 years. He worked as a clerk until age 66 when disability lead to retirement. On levodopa-carbidopa his extrapyramidal symptoms abated but he became preoccupied with intrusive sexual fantasies and ruminations concerning sexual topics. He began to insert objects into his penis and on one occasion a pencil had to be surgically removed. His medication was reduced and the aberrant sexual behaviour abated. He had no history of psychiatric disturbances or previous sexual dysfunction or paraphilic behaviour. He had been married for over 30 years and his wife also denied that he had ever shown an interest in atypical sexual practices.

Mental status was normal and general neurological examination demonstrated findings consistent with idiopathic Parkinson's disease. CT scan of the head was normal and EEG showed mild slowing. During a 6 year follow up period, the patient has had no recurrence of unusual sexual behaviour.

**Discussion**

The normal human sexual response has multiple components including arousal, copulation and orgasm. The stimulus leading to sexual arousal varies from person to person and is determined by a combination of experiential, genetic, and neurological factors. The organisation of the human sexual response and the neural basis for sexual preference is an area of neurology that is poorly understood and much of our information comes from lesion studies in animals. Animal studies are not completely applicable to humans, however, and even non-human primates have sexual behaviours that differ markedly from those of men and women. Hypososexuality is common with injury to the brain although the lesions seen with this condition are sufficiently variable that it is difficult to identify one specific area in the brain responsible for the diminished sexual interest. Hypersexual behaviour and change in sexual preference are less common following brain injury and study of hypersexuality in humans after focal brain injury cannot provide useful clues about areas of the brain involved in the normal sexual response. Likewise alterations in sexual preference associated with brain lesions may suggest which areas of the brain influence sexual orientation in humans. The cases presented here contribute to this evolving and complex field.

The patients described in this paper fall into two overlapping categories. All the patients developed a change in sexual behaviour (table). Cases 1 to 4 demonstrated an increase in sexual activity and Cases 5 to 8 exhibited an alteration in sexual preference with or without a heightened sexual drive. The first group of patients manifested a disinhibited public expression of their increased drive. This sexual disinhibition was often associated with a general disinhibition of behaviour, and in some cases the patients exhibited elements of secondary mania. Sexual disinhibition and public exhibitionism have been described with dysfunction of the basal frontal lobe, and two of our patients with the syndrome (patients 1 and 2) had CT scan evidence of injury in this region. In case 1 the injury was due to the rupture of an anterior communicating aneurysm, and in case 2 a subfrontal meningioma had been present. Exhibitionism has also been described in patients with Huntington's disease, epilepsy, multiple sclerosis, and Gilles de la Tourette syndrome. Between 5 and 35% of those arrested for exhibitionism are found to be suffering from organic disorders to which the behaviour can be at least partially attributed.

<table>
<thead>
<tr>
<th>Case</th>
<th>Gender</th>
<th>Age (yr)</th>
<th>Sexual behaviour</th>
<th>Lesion site</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>39</td>
<td>Public masturbation with sexual advances toward female nurses</td>
<td>Basal frontal</td>
<td>Anterior communicating aneurysm</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>59</td>
<td>Increased sexual drive with manic behaviour</td>
<td>Basal frontal</td>
<td>Meningioma</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>31</td>
<td>Verbal preoccupation with sex and &quot;erotic&quot; feeling lasting 1 month. &quot;Secondary mania&quot;</td>
<td>Right thalamic-hypothalamic</td>
<td>Infarction following subarachnoid haemorrhage</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>30</td>
<td>Sexual arousal post seizures. Interictal hyposexuality</td>
<td>Right temporal</td>
<td>Post-encephalitic seizure disorder</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>50</td>
<td>Pedophilia with impotence</td>
<td>Left midbrain-hypothalamic</td>
<td>Glioma</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>75</td>
<td>Voyeurism and sexual disinhibition</td>
<td>Hydrocephalus</td>
<td>Post-encephalitic</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>31</td>
<td>Change from hetero to homosexual preference</td>
<td>Bitemporal</td>
<td>Post herpes encephalitis</td>
</tr>
<tr>
<td>8</td>
<td>Male</td>
<td>71</td>
<td>Genital mutilation</td>
<td>Basal ganglia</td>
<td>Parkinsonism. Levodopa precipitated behaviour</td>
</tr>
</tbody>
</table>


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Patient 3 developed hyposexuality and post-ictal sexual arousal associated with temporal lobe seizures after recovering from limbic encephalitis. Hyposexuality in patients with temporal lobe seizures is well known and and 14 and meningiomas, suprasellar changes associated with focal brain lesions were found in the literature, but Berlin reported one voyeuristic patient with an elevated leutinising hormone (LH) level and a second with elevations of both LH and testosterone. These endocrine studies were not done in the cases reported here. Case 7 developed the Kluver-Bucy syndrome and changed from a heterosexual to a homosexual orientation following herpes encephalitis. Similar alterations in gender preference in association with the Kluver-Bucy syndrome have previously been reported, and a few patients were reported to have become disinhibited and publicly demonstrative.

Patient 4 had a profound verbal preoccupation with sexual matters and exhibited a manic syndrome. Secondary mania has been described following brain injury and is more common in patients, like case 4, with lesions in the thalamic and periventricular regions of the right hemisphere. Increased sexual drive is common in patients with mania although this patient's sexual preoccupation was unusually extreme. She described after recovery that she had experienced an erotic-erotician sensation throughout the period of her increased interest in sex.

The second group of patients (Cases 5 to 8) developed a change from what was previously a stable and established pattern of sexual behaviour. Like the first group, most of the patients (Cases 5, 6, and 7) also developed disinhibited public expression of their altered sexual behaviour. No single common anatomical area was involved in this second group of patients but in all cases the lesions were in or near the limbic system. The patients in this group with the most dramatic change in sexual preference had lesions in the temporal lobe and/or midbrain adjacent to the hypothalamus, and those with most marked sexual disinhibition also had frontal lobe damage.

Patient 5 manifested impotence and pedophilia associated with an infiltrating glioma of the midbrain-hypothalamic region (fig 3). This patient had undergone surgery and was frank to children. He became more disinhibited about his sexual preference. Pedophilia has previously been reported in association with post-encephalitic Parkinsonism, suprasellar meningiomas, post-anoxic encephalopathy, and epilepsy. Henn and co-workers found that of 111 offenders arrested for child molestation 14.4% had acquired organic psychosyndromes and an additional 13.5% were mentally retarded. Together these observations suggest that brain injury may lead to pedophilia, and conversely, careful assessment of pedophilic patients may lead to the discovery of associated neurological abnormalities.

In Cases 6 and 7, viral encephalitis leading to limbic area damage was the predisposing neurological factor. Patient 6 was sexually disinhibited and developed voyeurism, a new sexual interest for him. In addition to the encephalitis, this patient had a malpositioned shunt inserted into the septal region and obstructive hydrocephalus. No other patients with voyeurism associated with focal brain lesions were found in the literature.
The authors describe cases of increased sexual behavior following brain injury, particularly in the context of temporal lobe epilepsy. Postictal hypersexuality in association with temporal lobe epilepsy. Patient 6 manifested post-encephalitic voyeurism and patient 7 changed gender preference from heterosexual to homosexual after herpes encephalitis. Arousal, the pleasure associated with sexual activity, and orgasm may, in part, be mediated by monoaminergic compounds. Yohimbine elevates central norepinephrine levels and increases mounting behaviour in male rats even when associated with genital anaesthesia. Dopaminergic compounds have also been associated with increased sexual drive and Case 9 suggests that dopamine may play a role in sexual preference as well as drive.

Sexual arousal leads to increased copulatory activity. Although peripheral somatosensory inputs are important for this aspect of reproductive activity, human patients with paraplegia may experience arousal and even orgasm without peripheral sensory input, suggesting that central structures are sufficient for this experience. Copulatory behaviour may be induced by stimulating the septal region in primates, and Heath described orgasmic sensations in patients during stimulation of this region. The patients in this series with true hypersexuality (Nos 1, 2, and 3) had lesions involving or adjacent to the medial septal area.

All these aspects of reproductive behaviour are mediated by structures with extensive frontal and limbic connections. The basal frontal area has multiple connections with the thalamus, hypothalamus and other elements of the limbic system. Prominent efferent pathways connect the frontal lobe to the preoptic region of the hypothalamus and may control sexual drive. Behavioural changes may be the only manifestation of damage to the basal frontal area and this region is vulnerable to both trauma and hydrocephalus. The disinfibited behaviour seen with injury to this region may include inappropriate discussion of sex but increased sexual drive is less common. Two patients in this series with increased drive and actual increased sexual activity (Cases 1 and 2) had demonstrable lesions of the basal frontal lobe. In addition, several of the patients in this series had basal frontal injury in addition to other pathology that may have led to a mixed pattern with both alteration in sexual preference and disinhibited sexual activity.

These observations emphasise that specific sexual changes may occur following brain injury and in some cases the behavioural alterations may be the presenting or predominant manifestation of brain dysfunction. Hypersexual behaviour following brain injury is uncommon but when seen is often associated with basal frontal or diencephalic lesions. Drugs that increase central monoamines may produce a similar syndrome. Change in sexual orientation is more common with lesions in the limbic system and cases are described here with dysfunction of the hypothalamus and temporal lobe. Change in sexual behaviour should suggest the possibility of a brain lesion.

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References

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