

SURGICAL APPROACHES TO TUMORS AND EPILEPTOGENIC ZONES CLOSE TO WERNICKE'S AREA

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SUMMARY - Surgical procedures near to language related brain regions may cause severe morbidity in relation to speech. Operations performed under local anesthesia and intraoperative cortical mapping may minimize these risks. Six patients with tumors near the Wernicke's area were treated (2 low-grade astrocytomas, 1 ganglioglioma, 1 xanthoastrocytoma, 1 metastasis, 1 glioblastoma). Their clinical presentation consisted of epilepsy (n=4) and dysphasia (n=2). The skin and periosteum were infiltrated with local anesthetic and an ample craniotomy was performed. Cortical stimulation with an unipolar electrode was then carried out with concomitant speech testing (mainly comprehension and sequential speech). After mapping, the best surgical approach aiming to avoid the mapped area was elected. In 5 cases the resection was total and in 1, partial (glioblastoma). There was a transitory (10 days) worsening of the pre-operative deficit in 1 case (glioblastoma). In 3 patients, the speech areas were displaced: posteriorly (n=2) or anteriorly (n=1). Surgical procedures under local anesthesia are safe and may avoid post-operative language disturbances in patients with tumors near to Wernicke's area.

KEY WORDS: brain tumors, epilepsy, Wernicke's area, cortical mapping.

Abordagens cirúrgicas a tumores e zonas epileptógenas junto à área de Wernicke

RESUMO - A ressecção de processos expansivos em áreas relacionadas à fala pode causar morbidade severa de linguagem. A realização de procedimentos cirúrgicos sob anestesia local e mapeamento intra-operatório das áreas relacionadas à linguagem pode ser empregada para minimizar estes déficits. Seis pacientes com tumores da área de Wernicke foram mapeados (2 astrocitomas de baixo grau, 1 ganglioglioma, 1 xantoastrocitoma, 1 metástase, 1 glioblastoma). Sua apresentação clínica incluía epilepsia (n=4) e disfasia de compreensão (n=2). Após infiltração dos planos superficiais com anestésico local e craniotomia, procedia-se à estimulação com eletrodo unipolar do córtex temporal amplamente exposto, com testagem simultânea de linguagem, principalmente compreensão e fala sequencial. Após o mapeamento, elegia-se a melhor via de acesso de modo a evitar a área mapeada. Em 5 casos a ressecção foi completa e em 1 parcial (glioblastoma). Em 1 caso houve piora transitória (10 dias) de déficit pré-existente de compreensão e expressão (glioblastoma). Em 3 casos as áreas da fala haviam sido deslocadas: posteriormente (n=2) ou em direção suprasilviana (n=1). Procedimentos cirúrgicos com anestesia local são seguros e podem evitar distúrbios pós-operatórios de linguagem em pacientes com tumores próximos à área de Wernicke.

PALAVRAS-CHAVE: tumores cerebrais, epilepsia, área de Wernicke, mapeamento cortical.

The resection of lesions or cortex adjacent to speech related areas can cause language disturbances. At the early period of epilepsy surgery the majority of the procedures were performed under local anesthesia and included extensive intraoperative cortical mapping⁶. The motor and sensitive homunculi and the main speech-related and modality-specific areas were determined by these studies

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Aceite: 10-abril-1995.

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pioneered by the Penfield's group. More recently, the number of temporal lobe resections carried out under general anesthesia is rapidly increasing⁵. Procedures under local anesthesia are now used mainly in the treatment of lesions or epilepsies in the Wernicke's or Broca's areas². Only 6% of the patients are now operated under local anesthesia in our Center. General anesthesia provides more comfort for the patient and the surgeon. On the other hand, it is impossible to monitor speech while using general anesthesia.

This paper discusses the usefulness of intraoperative cortical mapping under local anesthesia in patients with lesions in speech-related areas.

METHODS

Six patients with tumors of the Wernicke's area were operated and mapped under local anesthesia (2 low-grade astrocytomas, 1 ganglioglioma, 1 xanthoastrocytoma, 1 metastasis, 1 glioblastoma) (Table 1). Their clinical presentation included epilepsy (n=4) and receptive dysphasia (n=2).

After infiltration of the skin and periosteum with local anesthetic, an ample craniotomy was performed and the cortex widely exposed. The motor and language-related areas were then mapped by means of stimulation using a unipolar carbon ball-electrode. Stimulus frequency ranged from 1 to 60 Hz and intensity from 3 to 12 mA. Positive motor responses included muscle twitches in the correspondent topography of the homunculus. Speech-related areas were determined as those where an aphasic block could be obtained after brief stimuli. After mapping, the best surgical approach was elected as to avoid speech areas.

Table 1. Clinical summary of the reported patients.

Patient	Topography	Pathology	Surgery	Results
I	T2/T3 Post.	Astrocytoma	Lesionectomy	Seizure free
II	T1/T2 Post.	Ganglioglioma	Lesion + Margin	Seizure free
III	Fusif/Parahip	Xanthoastrocytoma	Lesion + Margin	Seizure free
IV	Fusif/Parahip	Ganglioglioma	Lesion + Margin	Seizure free
V	T1/T2 Post.	Metastasis	Lesionectomy	Seizure free
VI	Parietal	Glioblastoma	Partial resec.	Rare seizures

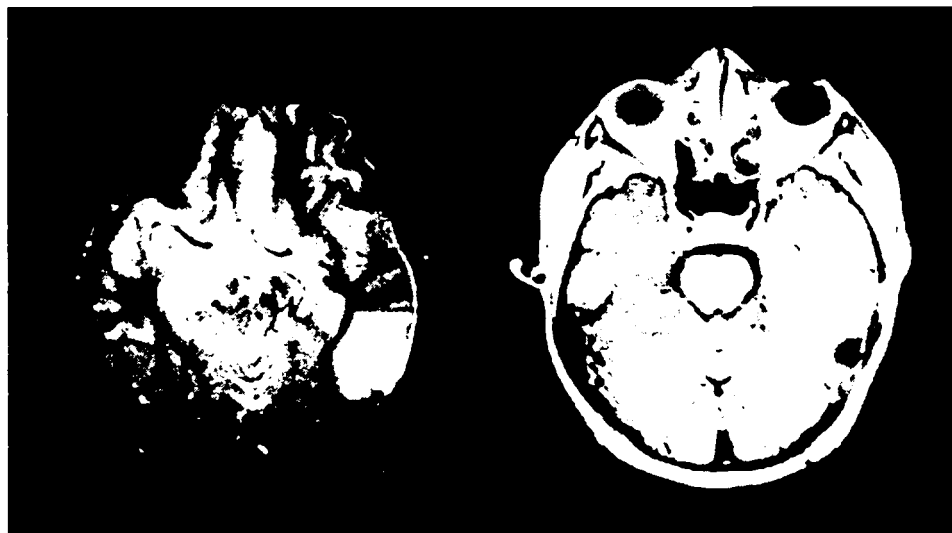


Fig 1. Pre- (left) and late (3 years) post-operative (right) MRI of a patient with a tumor near Wernicke's area.

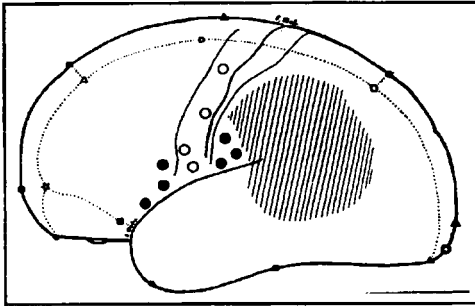


Fig 2. Diagram showing the intraoperative cortical mapping under local anesthesia in a patient with glioblastoma. Resection was partial (>90%) since part of the tumor encroached Wernicke's area. Wernicke's was displaced anteriorly towards the central sulcus. Hatched area = tumor; open circles = motor strip; black circles = speech areas.

Electrocorticography was also used to map the epileptogenic area in those patients presenting with epilepsy.

RESULTS

In five patients a total removal of the lesion and epileptogenic cortex was performed and in 1 (glioblastoma) the resection was partial (Fig 1). There was a transient increase (10 days) in the already present pre-operative dysphasia in 1 patient (glioblastoma) (Fig 2); in the others, there was no additional speech deficit. In 3 patients, Wernicke's area was displaced: posteriorly (n=2) (Fig 3) or in the suprasylvian direction (n=1) (Fig 4).

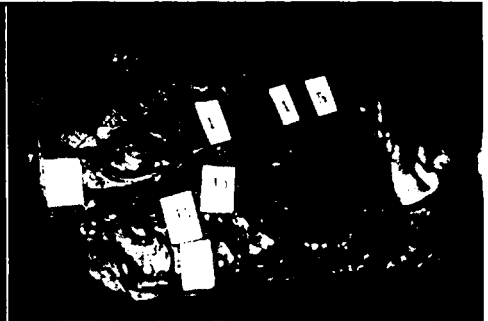


Fig 3. Left: MRI showing a left infero-mesial tumor in a patient presenting with seizures beginning with speech arrest. Right: intraoperative cortical mapping showing the epileptogenic area (numbers) and the motor strip (letters). The only speech related area in this case (white tag) was displaced posteriorly. The main venous trunk is the vein of Labbe.

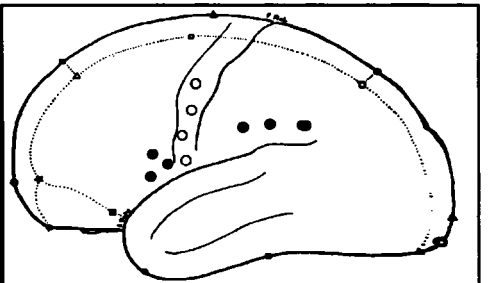
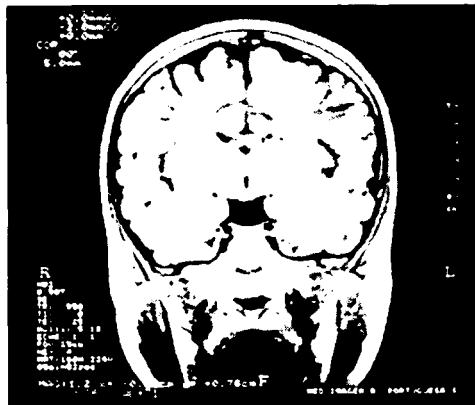


Fig 4. Left: MRI showing a left infero-mesial tumor in a patient presenting with epilepsy. Right: diagram of the intraoperative cortical mapping showing that the speech related areas were displaced in the suprasylvian direction. There was no temporal language area. Open circles - motor strip; black circles - speech areas.

COMMENTS

Surgery under local anesthesia and cortical mapping can be safely performed and may avoid language-related morbidity in patients with tumors or epilepsies in Wernicke's or Broca's areas⁹.

Speech deficits can occur after surgery in these eloquent areas¹⁰. Aphasia may be the result of the direct destruction of the language-related cortex (which is minimized by cortical mapping)¹, inappropriate vascular occlusion (specially main veins) or after distortion of the brain parenchyma after extensive tumor debulking. The deficit is usually transitory after parenchymal distortion. This happened in the patient with glioblastoma, where an extensive debulking of a huge tumor occupying the entire left parietal lobe was performed. On the other hand, this is often not the case when the eloquent cortex itself was resected or had major ischemia.

Dichotic listening³ and intracarotid sodium amyltal¹⁵ tests are able to determine the speech hemispheric lateralization, but can not determine the exact topography of these regions. Functional magnetic resonance imaging and positron emission tomography are able to further localize them but an exact correlation of these imaging techniques to the exposed cortex is not yet possible⁶. Anatomic asymmetries¹³, now perfectly shown with current imaging techniques (specially MRI) may add to the our hemispheric lateralization capability.

Luders et al⁷ have recognized a temporo-basal speech area after chronic stimulation with subdural electrodes in addition to the classic Broca's and Wernicke's areas. On the other hand, removal of this recently recognized temporo-basal speech area has not been associated to any detectable language disturbance as is often seen after injury to Broca's or Wernicke's areas or its connections^{11,14}.

In patients bearing intracranial tumors at or near to speech areas⁴ cortical mapping seems to be even more relevant since these regions could be displaced by the lesion from their original position. Exclusively suprasylvian speech areas are uncommon in patients without tumors (even in epileptics) but can be seen in patients with tumors.

Speech deficits are not necessarily related to verbal memory disturbances. The latter can occur after resections restricted to the amygdalo-hippocampal region or to cortical regions not related to speech. Cortical resections kept at least 1 cm away from the intraoperatively mapped speech areas are safe¹².

In patients with lesions of the Wernicke's area presenting with epilepsy, intraoperative electrocorticography and cortical mapping of motor and speech areas under local anesthesia may maximize the resection and offer excellent results in relation to the epilepsy and the tumor.

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