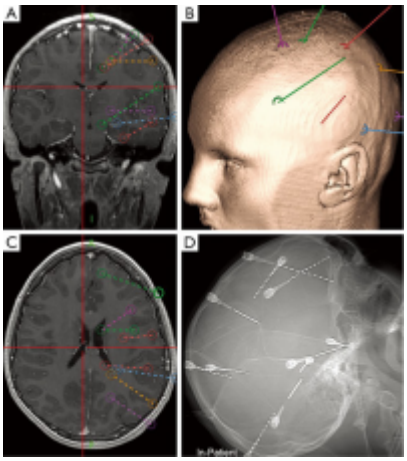
Radiofrequency thermocoagulation for epilepsy



Stereotactically guided radiofrequency thermocoagulation for epilepsy has been frequently applied over the last 40 years. Radiofrequency electrodes with temperature control function generate a coagulation lesion with clearly defined borders. In combination with high-resolution MRI imaging, this technique allows minimally-invasive ablation of periventricular nodular heterotopias, small focal type II dysplasias, and hypothalamic hamartomas [1].

Although less effective than resective surgery, radiofrequency thermocoagulation can be a reasonable therapeutic option in complex cases where anatomic constraints make impossible any cortical resection. Further prospective studies are needed to better define RFTC indications and to optimize its methodology [2].

Focal epilepsy in children may be refractory to pharmacological treatment and surgical resection may be an appropriate option. When invasive electroencephalogram is required in the presurgical evaluation, depth electrodes can be used to create focal lesions in the epileptogenic zone using radiofrequency thermocoagulation (RFTC), to disrupt the epileptogenic zone [3].

Case series

A study aimed to assess the efficacy and safety of RFTC in a paediatric population of 46 patients.

The mean age of onset was 3.3 years and the mean age at SEEG was 8.2 years. MRI lesions were identified in 71.7% of the series, among them 60% of malformation of cortical development. 43.5% of the patients were seizure free at 1 month, 26.1% were responders. The mean duration of improvement was 6.8 months. 8 children were seizure free for >8 months and among them, 6 are currently seizure free for 8-24 months. 5 patients had functional deficits post-procedures, transient in 4 patients and prolonged in one of whom. 3/5 were anticipated following the results of cortical stimulation. Multivariate analysis found 3 independent criteria linked to RFTC efficiency one month after RFTC: frequency of the seizures before RFTC, age and number of contacts used.

RFTC is a safe method for the paediatric population providing important predictive information for surgical resection. An improvement in seizure frequency, often transient, is seen in 2/3 of our

patients. RTFC could be useful as a palliative technique for children with an epileptogenic zone overlapping with eloquent areas, with minimal risk of sequelae [4].

Dimova et al., retrospectively reviewed the medical charts, video-SEEG recordings, and outcomes for 23 patients (aged 6-53 years) treated with SEEG-guided RFTC, of whom 15 had negative magnetic resonance imaging (MRI) findings, and 10 were considered noneligible for resective surgery after SEEG. Two to 11 RFTCs per patient (mean 5) were produced by applying 40-50 V, 75-110 mA current for 10-60 s on SEEG electrode contacts within the epileptogenic region, which was very close to eloquent cortices in 12 cases. The general features, SEEG findings, and RFTC extent of the patients were analyzed to extract potential preoperative predictors of post-RFTC seizure outcomes.

After a mean follow-up of 32 months (range 2-119 months), eight patients experienced a ≥50% decrease of seizure frequency after RFTC (R+, 34.8%), of whom one had a sustained seizure freedom and 15 patients did not benefit from RFTC (R-, 65.2%). The presence of an MRI lesion was the only significant predictor of a positive outcome, whereas location of epilepsy, extent of interictal epileptiform discharges (IEDs) and of the seizure onset zone, induction of seizures by electrical stimulation, as well as the ratio of the coagulated sites did not show a significant correlation to the RFTC response. However, (sub-)continuous IEDs were more frequently found in R+ than in R- patients, thus suggesting that this EEG marker of the epileptogenic tissue might predict a positive outcome even in patients without obvious MRI lesion.

The study confirmed that RFTC, although less effective than resective surgery, can be a reasonable therapeutic option in complex cases where anatomic constraints make impossible any cortical resection. Further prospective studies are needed to better define RFTC indications and to optimize its methodology [5].

Guénot et al., reported the technical data required to perform such multiple cortical thermolesions, as well as the results in terms of seizure outcome in a group of 41 patients. TECHNICAL DATA: Lesions are placed in the cortex areas showing either a low amplitude fast pattern or spike-wave discharges at the onset of the seizures. Interictal paroxysmal activities are not considered for planning thermocoagulation sites. All targets are first functionally evaluated using electrical stimulation. Only those showing no clinical response to stimulation are selected for thermolesion, including sites located inside or near primary functional area. Lesions are performed using 120mA bipolar current (50 V), applied for 10-30 sec. Each thermocoagulation produces a 5-7 mm diameter cortical lesion. A total of 2-31 lesions were performed in each of the 41 patients. Lesions are placed without anaesthesia.

20 patients (48.7%) experienced a seizure frequency decrease of at least 50% that was more than 80% in eight of them. One patient was seizure free after RF thermocoagulation. In 21 patients, no significant reduction of the seizure frequency was observed. Amongst the characteristics of the disease (age and sex of the patient, lobar localization of the EZ) and the characteristics of the thermocoagulations (topography, lateralization, number, morphology of the lesions on MRI) no factor was significantly linked to the outcome. However, the best results were clearly observed in epilepsies symptomatic of a cortical development malformation (CDM), with 67% of responders in this group of 20 patients ($p = 0.052$). Three transient post-procedure side-effects, consisting of paraesthetic sensations in the mouth (2 cases), and mild apraxia of the hand, were observed.

SEEG-guided-RF-thermolesioning is a safe technique. This results indicated that such lesions can lead to a significant reduction of seizure frequency. This experience suggests that SEEG-guided RF thermocoagulation should be dedicated to drug-resistant epileptic patients for whom conventional resection surgery is risky or contra-indicated on the basis of invasive pre-surgical evaluation, particularly those suffering from epilepsy symptomatic of cortical development malformation [6].

References

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