

Technique

# Epidural cylinder electrodes for presurgical evaluation of intractable epilepsy: technical note

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## Abstract

**Background:** This is a technical report describing a different technique for the insertion of epidural electrodes in the preoperative evaluation of epilepsy surgery. Our experience in 67 cases using this technique is analyzed.

**Methods:** Cylinder electrodes with multiple recording nodes spaced 1 cm apart along a Silastic core are placed into the epidural space under general anesthesia through single or multiple burr holes. We reviewed the data on 67 cases of medically intractable epilepsy requiring intracranial monitoring that had epidural cylinder electrodes placed. The electrodes were placed bilaterally or contralateral to subdural grids in 64 of the 67 cases. Continuous monitoring was performed from 1 to 3 weeks.

**Results:** This method was most useful when used bilaterally or contralateral to subdural grids. Definitive surgery was rendered in 48 of 67 cases. After monitoring, all electrodes were removed at bedside or upon return to the operating room for definitive surgery. There were no mortalities, infections, cerebrospinal fluid leaks, neurologic deficits, or electrode malfunctions. Two patients (2/67, 3%) did develop subdural hematomas early in our series after dural injury near the pterion; however, these patients did not sustain permanent deficit.

**Conclusions:** Epidural cylinders are another option for preoperative monitoring, useful for determining lobe or laterality of seizure genesis. They offer an alternate method to EPEs in cases where epidural recording is desirable. The cylinder electrodes are easy to place and can be removed without a return to the operating theater. The electrodes' minimal mass effect allows them to be safely placed bilaterally or contralateral to subdural grids. The epidural cylinders can monitor cortex with a greater density of nodes and can access regions not amenable to EPEs.

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## Keywords:

Electrocorticography; Electrodes; Epidural monitoring; Epilepsy surgery; Seizure surgery

## 1. Introduction

The success of epilepsy surgery is critically dependent on preoperative evaluation in localizing epileptogenic foci. Intracranial electrodes have become a necessity when noninvasive methods of determining a focus have failed or when results are incongruent. This article describes a different

technique for placement of epidural cylinder electrodes in the preoperative evaluation of intractable epilepsy.

Two types of epidural electrodes have been previously described, peg electrodes and epidural strips [1,2,4,5]. Penfield and Jasper [7] were the first to describe the epidural placement of monitoring electrodes. Goldring and Gregorie [4] described his use of epidural electrodes in 1984, wherein a craniotomy was performed and the dura deinnervated before placement of an epidural grid that was used for monitoring as well as stimulation. Kuzniecky et al [5] then described the placement of epidural strips without

*Abbreviation:* EPE, epidural peg electrodes.

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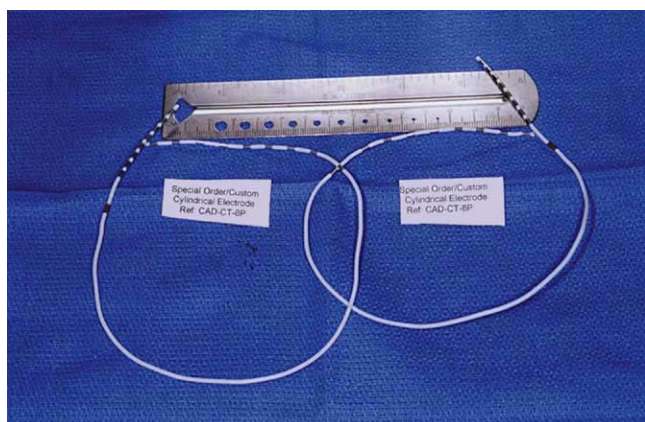


Fig. 1. Typical 8 node cylinder electrodes (Ad-Tech).

compromising dural integrity. Their electrode strips were placed using a craniectomy with passage underneath the temporal lobe. Awad et al [1,2] described EPEs consisting of a series of skin incisions and twist burr holes through which electrodes are placed over the cortex of interest.

Epidural cylinders, described herein, add additional versatility with ease of placement and removal. The cylinders can be placed through individual burr holes, obviating the need for full craniotomy. Dural integrity is maintained, mass effect is small, and they can be safely placed bilaterally. Epidural cylinder electrodes can also be removed at bedside after recording is finished, avoiding a return to the operating room (OR).

## 2. Methods

We reviewed the data on 67 cases from 1982 to 2000, requiring intracranial monitoring that had epidural cylinder electrodes placed. All patients had medically intractable focal seizures of at least 2 years' duration. There were 34 males and 33 females with an age range from 4 to 48 years. The patients all required intracranial monitoring secondary to failure of localization by noninvasive methods, particularly in questions of laterality in temporal cases or in question of lobe of origin.

Table 1  
Demographics of patients undergoing epidural cylinder electrode placement

Patients	67 of 631 cases
Sex	34 male, 33 female
Age range	4–48 y
Cylinders per patient	Range 1–8 (mode 4)
Contacts per cylinder	4–10 (mode 8)
Length of monitoring	1–3 weeks
Areas monitored	36 temporal 21 extratemporal 10 parasylvian
Bilateral	64 of 67
With subdural electrodes	37

All patients had at least 1 up to 8 multicontact epidural cylinders placed, with the average of 4 cylinders used per case. The epidural cylinders (Ad-Tech, Racine, Wis) are

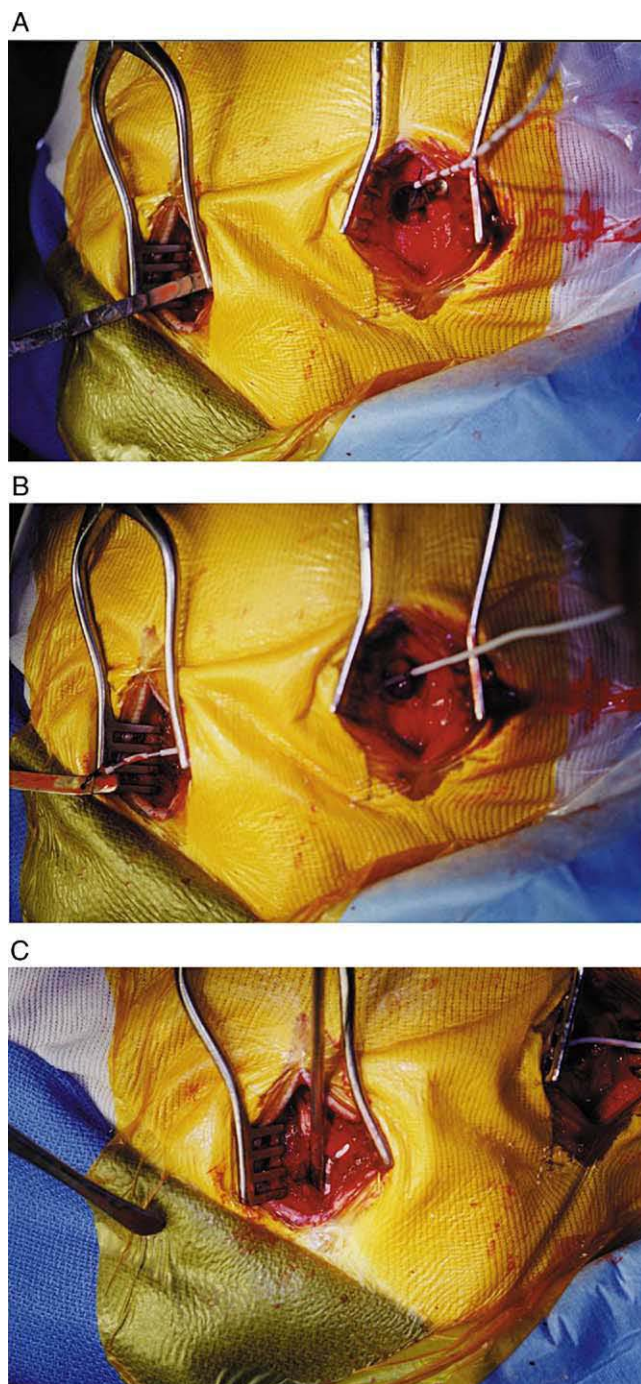


Fig. 2. Placement of the epidural cylinder electrodes through burr holes. A: After the burr holes are placed at a distance apart according to the length of the electrode, the end of the electrode is tied to the Gigli saw guide to be carried through the epidural space. B: After passage between burr holes, the guide is removed and the electrode untied leaving the distal end free. C: A blunt dissector is used to guide the remaining end of the electrode into the epidural space.

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