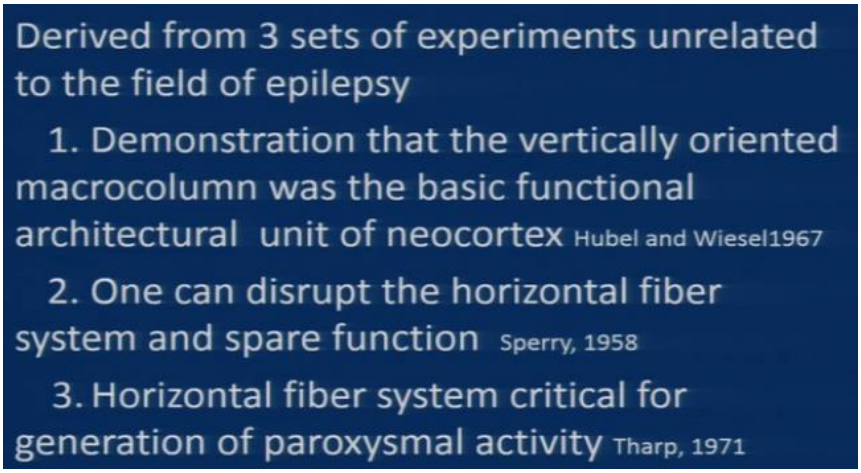
Multiple Subpial Transections (MST)

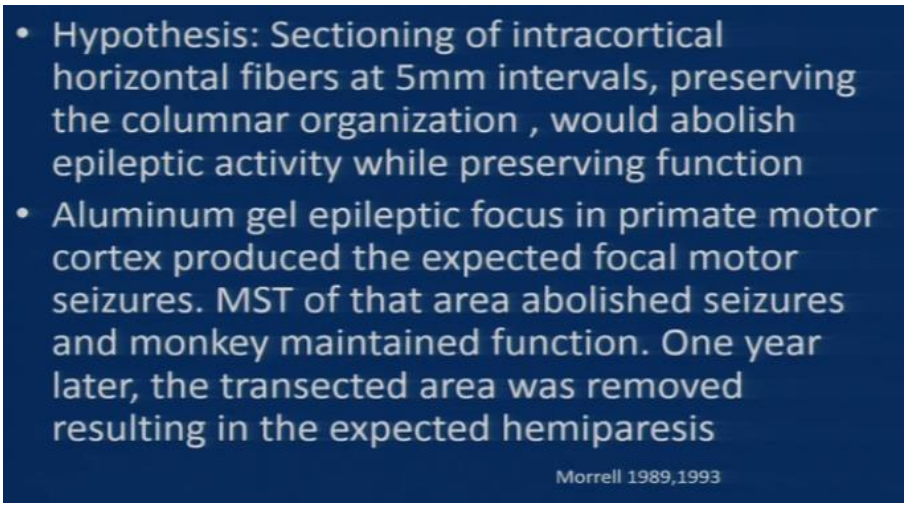
Last updated: September 18, 2024

– developed for epileptogenic zone involving eloquent cortex

- special indication - **Landau-Kleffner syndrome**, EPC in **Rasmussen's encephalitis**.
- seizure propagation occurs along long axis of gyri.
- nonresective surgical technique - ***horizontal*** *intracortical association fibers* (important for intracortical seizure propagation) are interrupted at 5-mm intervals; ***vertically*** *oriented projection fibers – columnar organization* (important for function) and pial nutrient vessels remain intact - ideal for treating epileptogenesis while preserving intrinsic cortical function!
- permanently disrupts side-to-side intracortical synchronizing neural networks and excitatory interneuronal conduction.
- because neocortex is organized in functional columnar units, cuts perpendicular to pial surface do not disrupt cortex-subcortical input-output interactions.
- cortical redundancy allows to sacrifice 20% of neurons without affecting function.

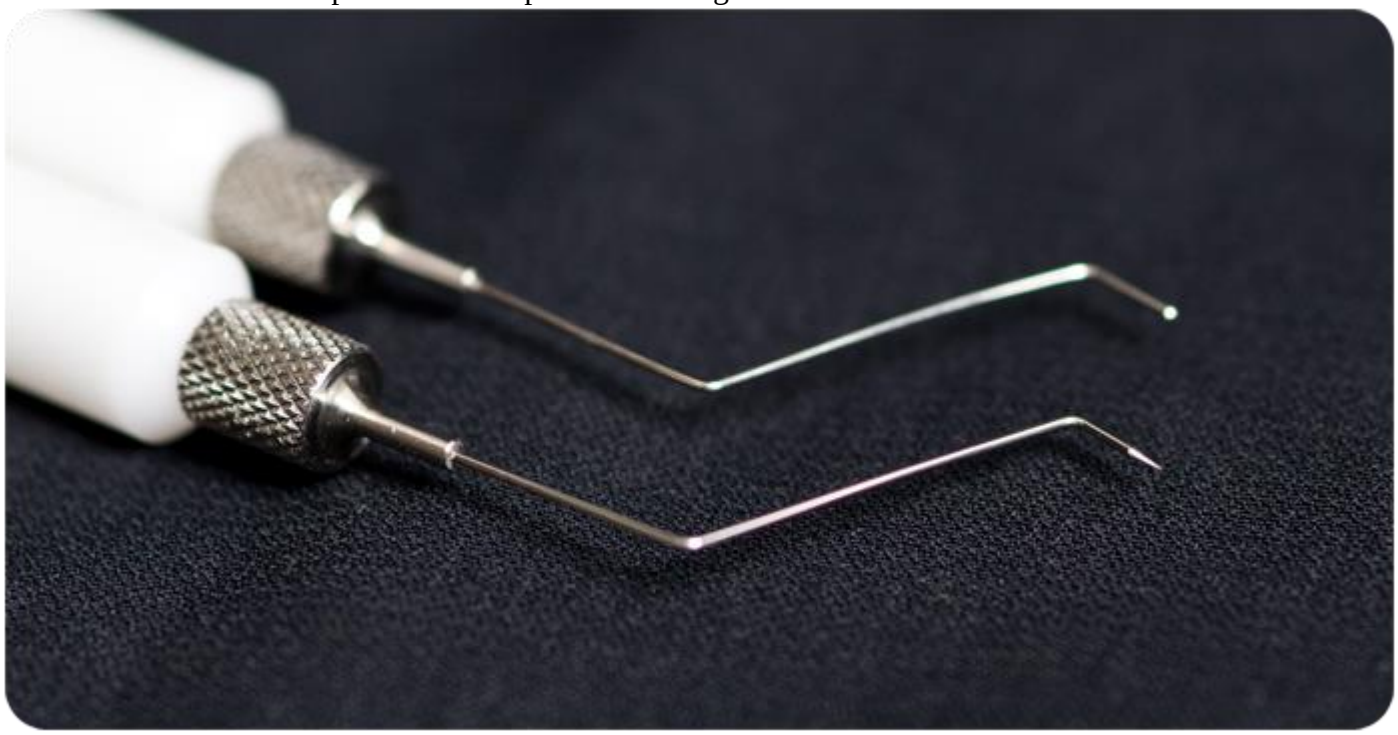
HISTORY



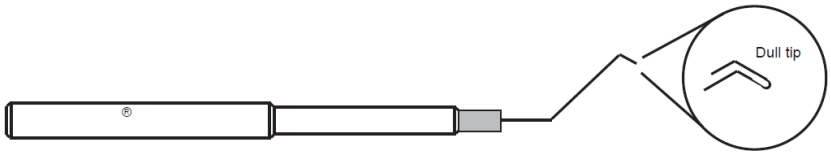


PROCEDURE

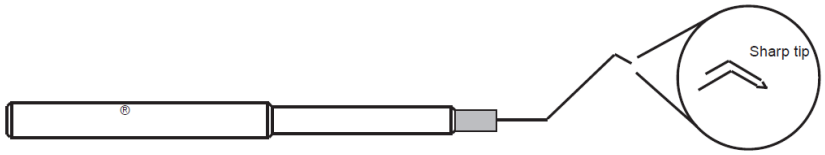
- as with all surgery for partial epilepsy, margins of epileptic focus must be defined clearly (using ***subdural grid electrode***).
- most cases involve *junction of central sulcus with Sylvian fissure*.
- entire region of ictal onset should undergo MST + 1-2 cm bordering ictal zone.
- **specially designed MST knife** (AD-TECH, Racine, Wis) with point angled downwards rather than upwards as originally described:
    - two different 0.55 mm diameter tip styles (dull & sharp).
    - bent distal portion of all tips is 5 mm long



Catalog #: MST-D03X
Pre-attached dull tip. (3/Box).



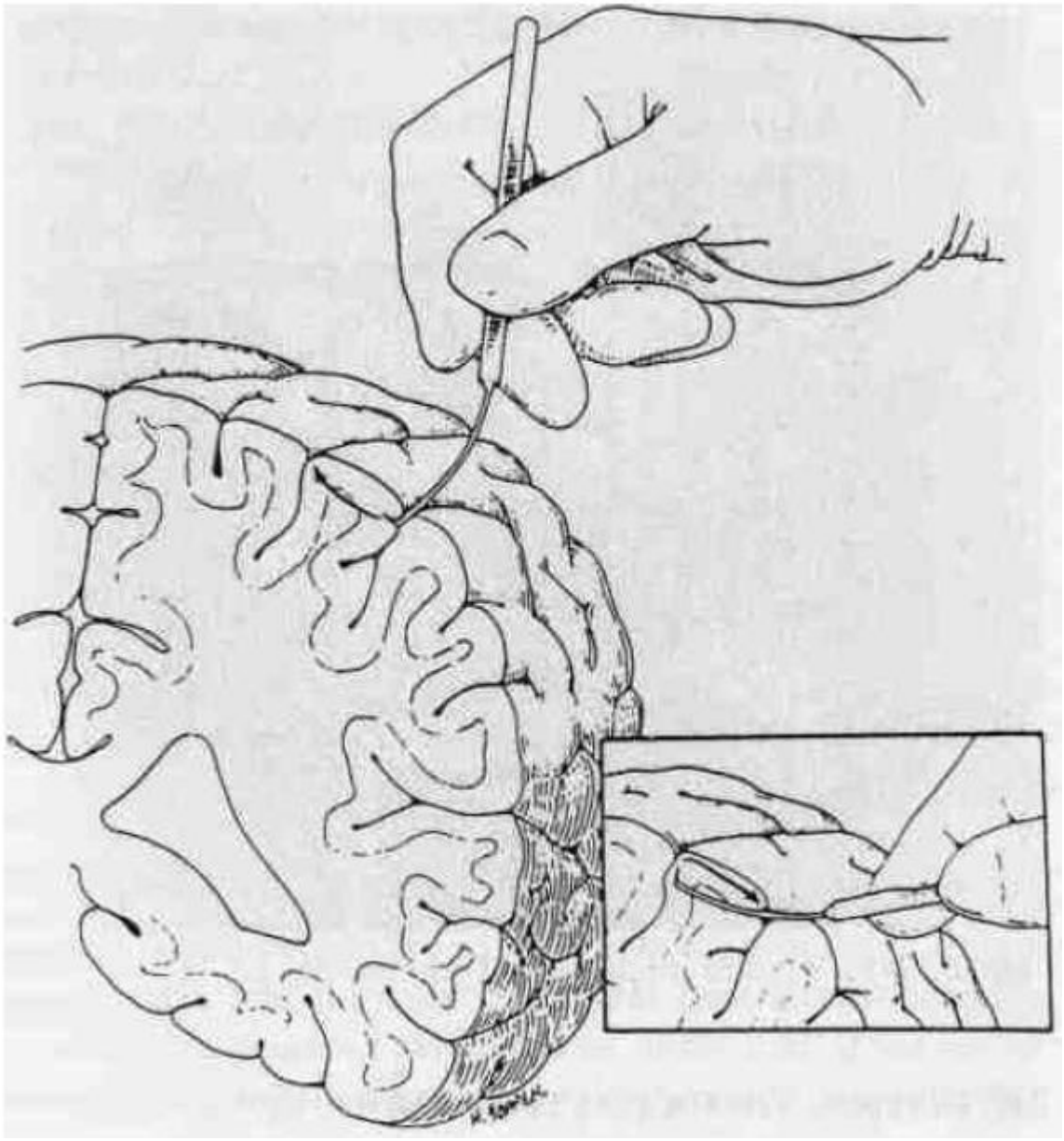
Catalog #: MST-S03X
Pre-attached sharp tip. (3/Box).

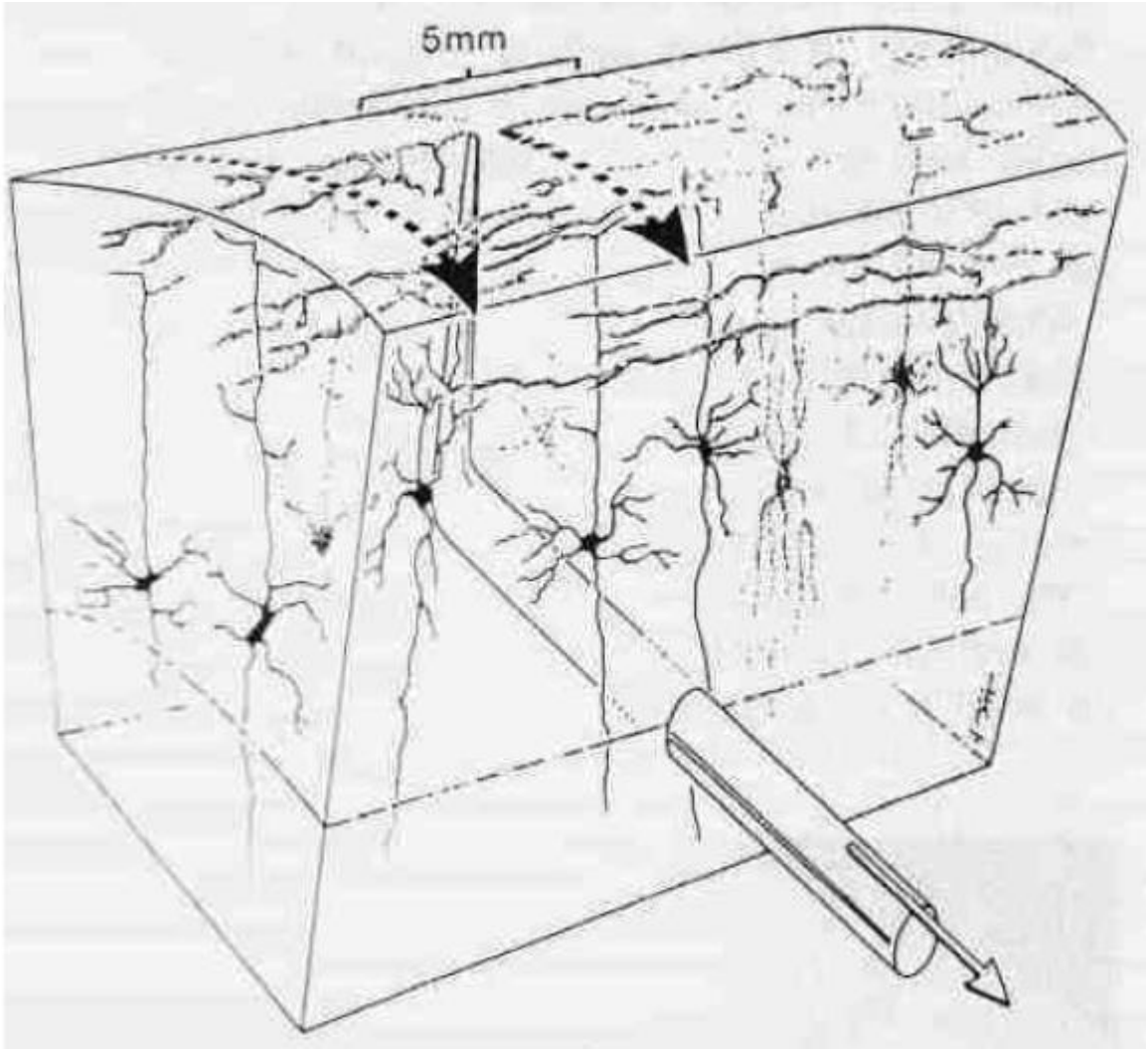


Catalog #	Description[1]
MST-D03X	MST handle with pre-attached dull tip. Box of three individually sterilized units
MST-S03X	MST handle with pre-attached sharp tip. Box of three individually sterilized units

- cutting portion of knife is sharpened to blade - to minimize excessive damage from using blunt instruments such as right-angled dissector.
- actual cuts should be performed ***under direct vision through operating microscope***.
- after protecting surrounding cortex with cotton patties, insertion point can be either at side or at crest of gyrus.

- after small pial spot is cauterized, knife blade is inserted and pushed subpially towards gyrus edge, making right-angled cut to long-axis of gyrus.
- cortex on average is 5 mm thick.
- horizontal arm to blade should be barely visible through pia at all times. If insertion point is centered in gyrus, then, after first half-cut, instrument is removed and replaced and remainder of slice is completed.
- parallel cuts then are made 4-5 mm apart until entire proposed ictal zone and surrounding area have been sliced (may monitor with intraop ECoG).
- it is expected to see ***capillary pial bleed*** – guides where next transection should be; at the end gyrus look striped.





- take care when encountering *gyrus curves* (outer length of curve is much longer than inner length – use staggering cut lengths so that slices converging at center of curve do not all join at common point or come so close together as to severely damage cortex).
- *pial bleeding* at blade insertion point usually is controlled with bipolar cautery or small square of thrombin-soaked Gelfoam; significant subpial hemorrhage should not occur.

COMPLICATIONS

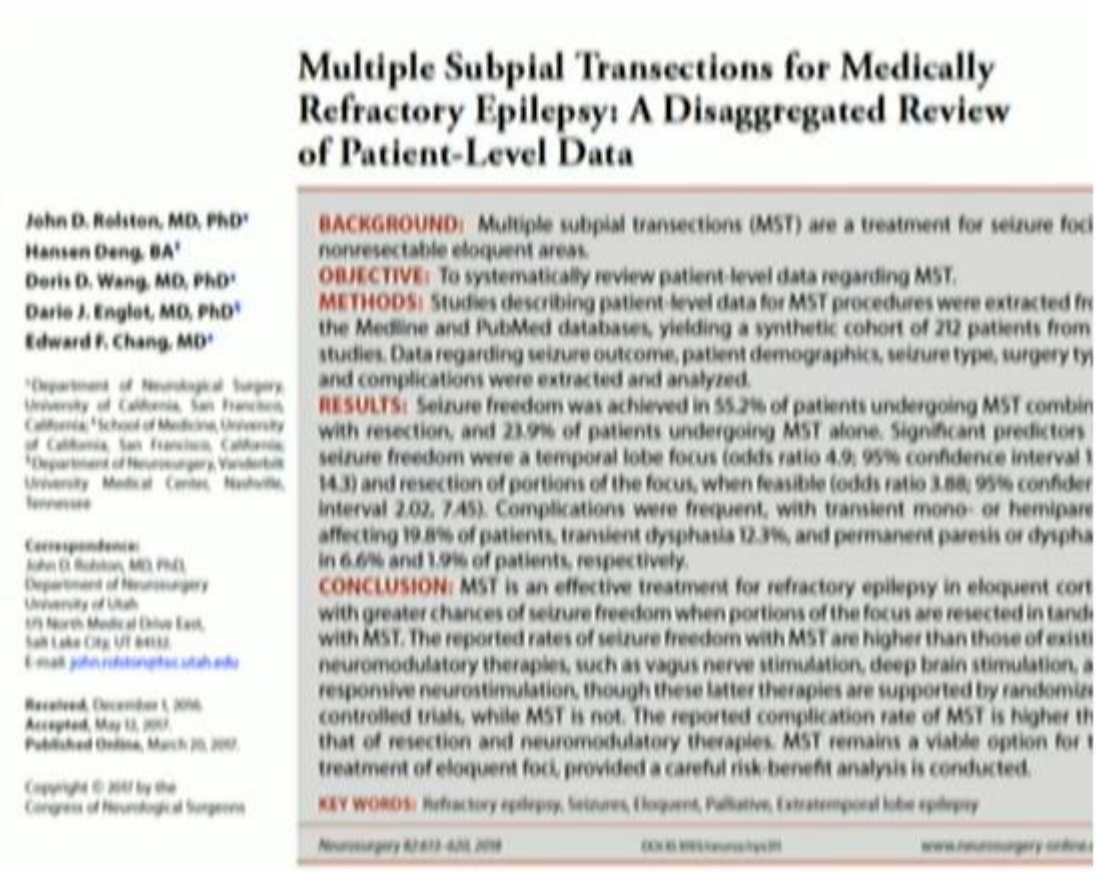
- Acute reversible morbidity included cortical swelling peaking post-op day 3-4 produced dysfunction in affected cortex- weakness, aphasia, sensory loss. Resolved 2-3 weeks
- Chronic morbidity in Rush series- 15% with 7% chronic deficits
- In literature, chronic deficits ranged from 3-19%

OUTCOME

Rush Series-37.5% seizure free at 2 years–Class I
-37.5% worthwhile outcome-Class II-III
Late reoccurrence reported 18-20%
Orbach in 2001 reported 30 patients MST only
- 10% Class I ; 45% Class II-III
Zhao in 2005 reported 80 patients MST alone
- 51.7 % Class I at 1 year follow=up

Spencer in 2002 reported 211 patients
- 87% excellent outcome (> 95% reduction) in GTC SZ
- 68% excellent outcome in CPS and SP
Zhao in 2005 200 patients MST +/- resection
-62.5% seizure freedom – Class I
-additional 20% -75% reduction
- 160 patients 1 year follow-up

MST better than RNS for eloquent foci (45% Engel I when combined with rxn; 24% Engel I isolated MST; Rolston et al., 2018)



Multiple Subpial Transections for Medically Refractory Epilepsy: A Disaggregated Review of Patient-Level Data

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Received, December 1, 2016.
Accepted, May 12, 2017.
Published Online, March 20, 2017.

BACKGROUND: Multiple subpial transections (MST) are a treatment for seizure foci nonresectable eloquent areas.
OBJECTIVE: To systematically review patient-level data regarding MST.
METHODS: Studies describing patient-level data for MST procedures were extracted fr the Medline and PubMed databases, yielding a synthetic cohort of 212 patients from studies. Data regarding seizure outcome, patient demographics, seizure type, surgery ty and complications were extracted and analyzed.
RESULTS: Seizure freedom was achieved in 55.2% of patients undergoing MST combin with resection, and 23.9% of patients undergoing MST alone. Significant predictors seizure freedom were a temporal lobe focus (odds ratio 4.9; 95% confidence interval 1 14.3) and resection of portions of the focus, when feasible (odds ratio 3.88; 95% confider interval 2.02, 7.45). Complications were frequent, with transient mono- or hemipare affecting 19.8% of patients, transient dysphasia 12.3%, and permanent paresis or dyspha in 6.6% and 1.9% of patients, respectively.
CONCLUSION: MST is an effective treatment for refractory epilepsy in eloquent cort with greater chances of seizure freedom when portions of the focus are resected in tand with MST. The reported rates of seizure freedom with MST are higher than those of existi neuromodulatory therapies, such as vagus nerve stimulation, deep brain stimulation, a responsive neurostimulation, though these latter therapies are supported by randomiz controlled trials, while MST is not. The reported complication rate of MST is higher th that of resection and neuromodulatory therapies. MST remains a viable option for t treatment of eloquent foci, provided a careful risk-benefit analysis is conducted.

KEY WORDS: Refractory epilepsy, Seizures, Eloquent, Palliative, Extratemporal lobe epilepsy

Neurosurgery 82:613–620, 2018 DOI:10.1093/neuros/nyx091 www.neurosurgery-online.

BIBLIOGRAPHY for ch. "Epilepsy and Seizures" → follow this LINK