Supplementary Material

Supplementary Table S1: Definitions of true positive (TP), false positive (FP), false negative (FN), and true negative (TN) outcomes across the four different DTA sub-analyses.

	True Positive(TP)	**False Positive(FP)**	**False Negative(FN)**	**True Negative(TN)**
Early-Transient Motor Deficit Analysis	Irreversible MEP change and early-transient motor deficit	Irreversible MEP change without early-transient motor deficit	Reversible MEP change/no MEP change and early-transient motor deficit	Reversible MEP change/no MEP change without early-transient motor deficit
Transient Motor Deficit Analysis	Irreversible MEP change and transient motor deficit	Irreversible MEP change without transient motor deficit	Reversible MEP change/no MEP change and transient motor deficit	Reversible MEP change/no MEP change without transient motor deficit
Permanent Motor Deficit Analysis	Irreversible MEP change and permanent motor deficit	Irreversible MEP change without permanent motor deficit	Reversible MEP change/no MEP change and permanent motor deficit	Reversible MEP change/no MEP change without permanent motor deficit
All Motor Deficits Analysis	Irreversible MEP change and motor deficit	Irreversible MEP change without any motor deficit	Reversible MEP change/no MEP change and motor deficit	Reversible MEP change/no MEP change without any motor deficit

Supplementary Table S2: Patient characteristics, neuromonitoring settings and interventions

Authors	Type of lesion (Age of patients)	Stimulation Parameters	Recorded Muscles	Intervention after warning
TUMORS AND OTHER BRAIN LESIONS				
Giampiccolo et al.(2021)	glioma (low/high grade) cavernoma ependymoma metastasis meningioma lymphoma DNET (mean age =49y, SD =15)	-DCS - Multi-train (p=5, ISI=2ms, pd=0.5 ms)	APB,ED, QUAD,AH,TA	N/A
Gogos et al.(2020)	glioma ependymoma (17-81y)	-DCS & TES -m/bDsCS -Multi-train (p=0-9, pd=0.05-0.5 ms, ISI= 1-4 ms, si/TES=0–200 V,si/DCS=0-20mA,si/DsCS≤20mA)	Contralateral: face, upper arm, forearm, hand, upper leg, lower leg, and foot muscles	Halt of resection
Mammadk-hanli et al. (2020)	glioma (low/high grade) metastasis cavernoma meningioma AVM	-DCS -Multi-train (p=5, f=500 Hz, pd=0.3 ms, si=180V)	N/A	-Halt of resection and waiting for 10 minutes -60 Hz interference control -Steroid
Seidel et al.(2020)	glioma metastasis vascular lesions (mean age =48y, SD =15)	-DCS - mDsCS - Multi-train (p=5, pd=0.5 ms ,f=250 Hz, ISI=4 ms,si/DsCS≤20mA)	Contralateral: face, distal and proximal upper and lower limbs	-Halt of resection(stop of resection if ≥15 min MEP change) -Ruling out technical confounders -Normalizing anesthesia -Increase of CPP -Nimodipine -Removal of brain retractor
Abboud et al.(2019)	unilateral supratentorial lesions not involving the PMC (mean age =52y, SD =16)	-TES - Multi-train (p=5, ISI=2ms, pd=0.5 ms, si≤400V)	Bilateral: APB,TA,OO	-Halt of resection(stop of resection if ≥15 min MEP change) -Warm irrigation -Reposition of brain retractor

Majchrzak et al.(2018)	thalamic tumors (20–65y,mean age=37y)	-TES - Multi-train (p=4-6, ISI=3–4 ms, pd=0.5 ms, si≤220 mA)	-Contralateral: thenar,hypothenar, triceps surae,TA -Ipsilateral thenar (negative control)	N/A
Moiyadi et al.(2018)	glioma (low/high grade) metastasis ependymoma embryonal tumors (3-70y, mean age =38.3y)	-DCS &TES -mDsCS -TES(Multi-train, p= 5, ISI=3ms, pd=0.5ms) -DCS(Multi-train, p= 4, ISI=4ms, pd=0.5ms)	-Contralateral: FCR,APB,TA,EDB -One ipsilateral muscle (negative control)	-Halt of resection -Ruling out hemodynamic, systemic and anesthetic factors and strip electrode displacement -Release of brain retraction -Warm irrigation(5-10 min)
Plans et al.(2017)	glioma (17–73 y, mean age =47.29 y)	-DCS -mDsCS - Multi-train (p=5, ISI=4ms, pd=0.5ms, si/DCS≤25mA, si/DsCS≤25mA)	Bilateral: APB,ED,AH,TA	-Halt of resection -Ruling out strip electrode displacement -Increase of BP -Papaverine -Warm irrigation
Zhou et al.(2017)	AVM (6–76y,mean age= 34.9 y)	-DCS &TES - Multi-train (p=3-5, ISI=1-5ms)	N/A	-Increase of BP -Cooling -Inducing burst suppression -Removal of the clip or retractor
Abboud et al.(2016)	gliomas not involving the PMC (25–81 y,mean age=56 y)	-TES - Multi-train (p=5, ISI=2ms, pd=0.5 ms,si≤400V)	Bilateral: APB,TA,OO	-Halt of resection -Reposition of brain retractors -Warm irrigation
Boex et al.(2016)	glioma meningioma metastasis dysplasia (1-79y,median age =53y)	-DCS &TES - Multi-train (p=5, f=350 Hz, ISI=2.9 ms, pd= 0.4ms, si/DCS≤ 12 mA, si/TES≤180 mA)	-Contralateral: BB,FCR,thenar,lumbrical QUAD,TA,GAST, AH -Ipsilateral hand and foot muscle (negative control)	-Halt of resection -Verification of MEP decrease with a stimulation increase(max 5%) -Imaging and neuronavigation reappraisal
Obermueller et al.(2015)	glioma metastasis	-DCS - Multi-train (p=5, f=350 Hz, pd=0.2-0.3 ms, si=6-30mA)	-Contralateral: BB,FCR,APB,ADM,TA	-Halt of resection -Removal of spatulas -Irrigation(warm Ringer's solution or nimodipine)

	(glioma:16-84y,mean age=53.3y) (metastasis:24-89y,mean age=61y)			
Shiban et al.(2015)	glioma metastasis (32–78y,mean age=53y)	-DCS -mDsCS - Multi-train (p=5, f=500 Hz, pd=0.4ms, si/DCS=14-26mA,si/DsCS≤20 mA)	BB,FCR, thenar, hypothenar,TA	-Halt of resection -Removal of spatulas -Irrigation(warm Ringer's solution)
Lee et al.(2014)	glioma meningioma metastasis craniopharyngi-oma granuloma cavernoma (24–80 y,median age=58y)	-TES - Multi-train (p=3–5, ISI=1-3ms,pd=0.5ms, si=200-400 V)	Bilateral: FCR,FCU, thenar, hypothenar,TA,GAST, AH,ADM	-Halt of resection -Release of brain retraction -Restoration of BP
Gempt et al.(2013)	glioma (low/high grade) (18–80 y, mean age =56y,SD=16)	-DCS - Multi-train (p=5, f=350 Hz,pd= 0.2-0.3 ms, si=6-30mA)	Contralateral: BB,FCR,APB,ADM,TA	N/A
Ostrý et al.(2013)	solitary lesion compressing or infiltrating the CST (19-73y,mean age= 48.8y)	-DCS -mDsCS - Multi-train (p=5 ,f=500 Hz, pd=0.4 ms, si/DCS=5-10% above ST, si/DsCS≤30mA)	Contralateral: BB,APB,ADQ,ED,QUAD, GAST,TA,AH	Resection interruption and subcortical mapping (If threshold increase ≥2 mA)
Pastor et al.(2013)	primary brain tumors (mean age= 49.8y, SD=2.4)	-DCS &TES - Multi-train (DCS:p=4–6 ,f= 500 Hz, pd= 0.15ms ,si=4-30mA TES: p=5–6, f=500 Hz, pd=0.05ms,si=100–320 V)	Contralateral: OO, DELT,BB,TRI,FC,ED, thenar,TA,AH,ADM	-Changing of resection area -Halt of resection - Irrigation(warm saline)
Seidel et al.(2013)	intrinsic brain tumors, metasta-ses and vascular lesions not involving the PMC	-DCS - mDsCS - Multi-train (p=5,f=250 Hz ISI=4 ms, pd=0.5 ms, si/DsCS≤22 mA)	Contralateral: face, distal and proximal upper and lower limbs	-Halt of resection(stop of resection if ≥15 min MEP change) -Ruling out technical confounders -Normalizing anesthesia

	(mean age= 50y, SD=17)			-Increase of CPP -Nimodipine -Removal of brain retractor (rarely)
Sakurada et al.(2012)	glioma	-DCS -N/A simulation parameters	N/A	N/A
Senft et al.(2012)	glioma (low/high grade) (mean age=47.7y, SD=13.3)	-DCS &TES - Multi-train (p=5, ISI=4ms, pd= 0.5ms)	N/A	-Halt of resection -Irrigation(warm saline) -Reappraisal of surgical strategy
Hatiboglu et al.(2010)	Glioma (age range of the 16 patients N/A)	-DCS -Multi-train (p=5, f=500Hz, pd=0.3-0.5 ms, si≤20 mA)	Contralateral: forearm, hand, leg and foot muscles	N/A
Ichikawa et al.(2010)	AVM (9-56y)	-DCS -Multi-train (p=5, f=500Hz, pd=0.2ms, si=10-35 mA)	Contralateral: FCR,thenar,TA	-Stop of surgical maneuvers -Hemostasis
Szelényi et al.(2010)	glioma metastasis meningioma hemangioblastoma colloid cyst (7-70, mean age=42.8, SD=18.2)	-TES -Multi-train (p=5, ISI=4ms, pd=0.5 ms, si/TES=ST+10-20%ST)	Bilateral: APB, TA Contralateral: BB,ED Sometimes QUAD,AH	-Ruling out technical failures and anesthetic/ systemic confounders -Reappraisal of surgical step -Halt of resection -Replacement of retractor
Kombos et al.(2009)	intrinsic insular tumors (23-61y)	-TES -mDsCS - Multi-train (p=5, f=500 Hz,pd=0.3 ms, si/TES≤400 V, si/DsCS≤10mA)	Contralateral: forearm flexor, thenar, QUAD	-Halt of resection -Papaverine
Neuloh et al.(2009)	glioma metastasis cortical dysplasia	-DCS &TES - Multi-train (p=5-7 ,f=250-500Hz, ISI= 2-4 ms, pd= 0.3-1msec DCS /si≤30mA, TES /si≤100mA)	forearm flexor, thenar, hypothenar,TA	-Halt of resection -Cessation of vascular manipulation -Readjustment of brain retractors -Papaverine
Neuloh et al.(2007)	insular glioma (9-73y, median age=39y)	-DCS &TES - Multi-train	distal UE muscles distal LE muscles	-Halt of resection -Readjustment of brain retractors -Papaverine

		(p=4-7 ,f=250-500Hz, ISI= 2-4 ms, pd= 0.2-0.7msec DCS /si≤30mA, TES /si≤100mA)		
Suess et al.(2006)	glioma metastasis meningioma cavernoma AVM PNET chondroma epidermoid cyst (16–87y, mean age=57.3y)	-DCS - Multi-train (p=5-7,f=400-500 Hz, pd=0.3 ms, si≤25mA)	Contralateral: FCR,FCU,APB,PL, FDS,QUAD,GAST	-Release of spatulas -Stop of electrocoagulation -Check of strip electrode position
Neuloh et al.(2004)	glioma meningioma metastasis AVM (11–79 y,median age=35y)	- DCS - Multi-train (p=4-7,f=250-500Hz, ISI= 2-4 ms, pd=0.2-0.7msec si≤30mA)	Contralateral: forearm flexor, thenar, hypothenar, sometimes TA,OO,QUAD	- Exclusion of technical reasons - Increase of stimulus intensity up to maximum(if persisting MEP loss from all muscles in a limb) - Readjustment of brain retractors -Papaverine -AVM: tamponade instead of electrocoagulation, increase of BP
Kombos et al.(2001)	glioma meningioma metastasis AVM epidermoid cyst (16–79y,mean age= 56.2y]	-DCS -Multi-train (p=7–10, f=400-500 Hz, pd=0.2-0.7 ms, si= 16.9 ± 7.76 mA)	Contralateral: forearm flexor, thenar, QUAD	- Check of electrode position and equipment -Release of brain retractor
Zhou et al. (2001)	glioma metastasis meningioma ependymoma (6-63y, mean age=43, SD=12.9)	-TES -Multi-train (p=5, pd=0.5 ms, si=40–160 mA)	Contralateral: BB,APB,TA,OO Ipsilateral: APB(negative control)	-Repeat stimulation with increased si or number of stimuli (train of seven) -Ruling out nonsurgical factors -Cessation of dissection -Reposition of the retractor

Cedzich et al.(1996)	glioma meningioma metastasis angioma cavernoma (4-74y, mean age=45.5y)	DCS (p=1-5,f=500 Hz, pd=0.2-0.4ms, si=6-20 mA/ 30-110 V)	Contralateral: forearm flexor, thenar, hypothenar,sometimes TA	N/A
EPILEPSY SURGERY				
Koo et al.(2019)	Temporal lobe epilepsy surgery (26–47 years, mean age= 33.3y,SD=8.6)	-TES -Multi-train (p=5, ISI=2ms, pd=0.05-0.2 ms, si≤400V)	Bilateral: APB,ADM,TA,AH	-Halt of resection -Release of brain retraction -Increase of BP -Irrigation(warm saline, nimodipine, papaverine) -Reappraisal of surgical strategy
Neuloh et al.(2010)	Intractable focal epilepsy-lesionectomy (2-66 y,median age= 25.5y)	-DCS &TES -Multi-train (p=5-7, ISI= 2-4 ms, pd=0.3-1 ms, DCS/si≤30mA, TES /si≤100 mA)	Distal limb muscles	Technical and surgical troubleshooting
ANEURYSM CLIPPING				
Guo et al. (2021)	MCA aneurysms (14-77y,mean age=53.93y, SD= 10.75)	-TES -Multi-train (p=8,f=250-500Hz, ISI=0.05-0.5ms, si=100-400V)	APB,AH	- Exclusion of anesthetic/physiological effects -Release of temporary clip -Reposition of permanent clip
Park et al.(2021)	ACA,ICA, MCA, AChA AcoA,PcoA aneurysms (mean age=61.27y, SD=9.04)	-TES -Multi-train (p=5,ISI=1-4ms, pd=0.5 ms,si=200–350 V)	Bilateral: APB,FCR,TA,AH	-Release of temporary clip -Release / reposition of permanent clip -Relief of brain retractor - Ruling out changes of BP, BT and anesthesia
You et al.(2021)	ICA aneurysms (mean age=53.7y, SD=10.6)	- TES -Multi-train (p=5-8 ,f=250-500Hz, pd=0.05-0.5ms,si=100-400V)	Bilateral: APB,AH	N/A

Kameda et al.(2020)	MCA aneurysms (age:N/A)	-DCS & TES -Multi-train (p=5, pd= 0.5ms, si=20% above ST)	Bilateral: thenar	-Release of temporary clip -Reposition of permanent clip
Byoun et al.(2019)	AChA aneurysms (mean age=54.66y, SD=9.12)	-TES -Multi-train (p=5,ISI=2-4ms, pd=0.05 ms,si=250-500V)	Contralateral: APB, ADM,TA,AH	Increase of stimulation intensity within 30% of baseline
Greve et al.(2019)	ACA,ICA, MCA Aneurysms (20–77y,mean age=57y,SD= 11)	-TES -Multi-train (p=4-5, ISI= 2-4msec, pd=0.5ms)	Bilateral: APB,TA	Technical, surgical, and anesthesiological troubleshooting
Li et al.(2019)	Anterior and posterior circulation aneurysms (18–77y, mean age=54y)	-TES -Multi-train (p=8, pd=0.5-1ms, ISI=2-5ms,si= 100–400 V)	Bilateral: APB,AH	-Loosening the clip -Unblocking the occlusion
Choi et al.(2017)	ACA, AchA,MCA, PCA,PcoA aneurysms (27–86y,mean age=57.5y,SD= 9.3)	-TES - Multi-train at 300-350V	Bilateral: DELT,thenar,TA,AH	-Stop of dissection -Relief of brain retractor -Release / reposition of aneurysm clips
Komatsu et al. (2017)	AChA,ICA, LSA.MCA aneurysms (temporal occlusion of the parent artery)	-DCS -si=5-15mA	Bilateral: APB,BB,DELT QUAD,GAST,TA	Release of temporary clip
Staarman et al.(2017)	ACA,ICA, MCA,PCA AChA AcoA,PcoA, ophthalmic, BA, VA, SCA, PICA aneurysms	-TES -Multi-train (p≤7, pd=0.3ms, si=30-125V)	APB, ADM,FCU, GAST,TA,AH	N/A
Kim et al.(2016)	Cerebral aneurysms (26–82y, mean age=56.8y)	-TES -Multi-train (p=6, pd=0.5ms, ISI=3ms,si= 265.6±72.67 V)	Bilateral: APB,TA,AH	Reposition of clip
Maruta et al.(2016)	ACA, ICA, MCA, AcoA aneurysms 30-89y, mean age=61.1y, SD=11.1)	-DCS & TES -Multi-train (p=5, pd=0.2-0.5ms, f=500Hz,si/DCS=ST+2mA si/TES= ST+2V)	APB,SOL,TA,AH	N/A

Song et al.(2015)	Giant intracranial ICA aneurysms (24–60y, mean age=44y,SD=12.1)	-TES -Multi-train (p=5, pd=0.1ms, ISI=2ms,si= 300-400V)	Bilateral: APB,AH *ipsilateral as negative control	-Release of temporary clip -Increase of BP
Sasaki et al.(2014)	AchA,LSA,MCA aneurysms (age:N/A)	-DCS & TES -N/A simulation parameters	N/A	Reposition of clip
Takebayashi et al. (2014)	ICA, MCA large and giant aneurysms (14-79 years (mean age=53.2y, SD= 8.9)	-DCS -Multi-train (p=5, f=500Hz,pd=0.2ms)	Contralateral: thenar	-Correction of clip position -Readjustment of retractors -Increase of BP -Papaverine
Yue et al.(2014)	MCA aneurysms (17-67y, mean age=48.1y,SD=10.6)	-TES -Multi-train (p=5, ISI=2ms,pd=0.1ms, si=100-400V)	Bilateral: APB,AH	-Relief of brain retractor -Release of temporary clip -Reposition of permanent clip
Dengler et al.(2013)	EC-IC bypass surgery (giant intracranial aneurysms) (14-76 y, mean age=50.2y)	-TES -Multi-train (p=5, f=500Hz,pd=0.3ms, si≤400V)	Contralateral: forearm flexor, thenar, TA	-Ruling out nonsurgical factors -Release of temporary clip -Increasing the speed of suturing -Increase of BP
Kang et al.(2013)	ACA, ICA, MCA, AcoA,PcoA aneurysms (33-74y, mean age=48y,SD=8.7y)	-TES - Multi-train (p=5, ISI=2 ms, pd=0.2ms)	Contralateral: BR,APB,TA,AH	-Nimodipine -Papaverine
Maruta et al.(2012)	ACA, ICA, MCA, AcoA aneurysms (3 meningiomas, 1GBM) (40-85y, mean age= 63y,SD= 10.8)	-DCS & TES - Multi-train (p=5,pd=0.5-1ms,ISI=2ms,si=ST+2mA and ≤30mA)	SOL,TA,AH	N/A
Shi et al.(2012)	ACA, ICA, MCA, PCA,AcoA,PcoA, aneurysms	-TES Multi-train (p=3-7,pd=0.05,ISI=1-2ms,si=100-400V)	OO,APB,AH	-Adjustment of temporary clip -Papaverine -Relief of brain retractor

Motoyama et al. (2011)	ACA, ICA, MCA aneurysms (42-79y, mean age= 62.1y,SD= 8.9)	-DCS & TES - Multi-train (p=5, ISI=2ms, si/TES= ST +20V, si/DCS= ST +2 mA and ≤30mA)	Bilateral: APB	Reposition/Release of the clip
Irie et al. (2010)	ICA,MCA,AchA, PCoA,ophthalmic/ paraclinoid artery aneurysms (mean age=66y, SD=11)	-TES - Multi-train (p= 5, ISI=0.5 ms, si=500 V)	Bilateral: APB,thenar	Reposition/ Release of the clip
Yeon et al.(2010)	ACA,ICA, MCA, AChA AcoA,PcoA aneurysms (mean age=55y)	-TES - Multi-train (p=5, ISI=2ms, si=300–400 V)	Bilateral: APB,ADM,TA,AH	N/A
Szelényi et al.(2007)	ACA,ICA, MCA, AcoA, posterior circulation aneurysms (mean age=51.5y, SD=14.7)	-DCS & TES -Multi-train (p=5, ISI=4ms, pd=0.5 ms, si/TES=ST+5%ST, si/DCS≤ 25mA)	Bilateral: APB, TA,AH Contralateral: BB,ED	-Ruling out non-surgical confounders by recording TES-MEPs from both hemispheres -Reappraisal of surgical strategy
Weinzierl et al.(2007)	ICA, MCA, PcoA aneurysms (age range of the 18 aneurysm-patients N/A)	-TES -Multi-train (p=4, ISI=2ms, pd=0.2 ms, si=100-700 V)	Bilateral: APB, TA	-Ruling out hemodynamic/systemic factors and technical confounders -Release of temporary clip -Release of retraction -Reposition of permanent clip
Szelényi et al.(2006)	ACA, ICA, MCA, PCA,AcoA,PcoA, AchA, ophthalmic Artery,BA, PICA,SCA aneurysms (9-85y, mean age=51.2y, SD=15.8)	-DCS & TES -Multi-train (p=5, ISI=4ms, pd=0.5 ms, si/TES≤ 240 mA, si/DCS≤ 33mA)	Bilateral: APB, TA Contralateral: BB,ED	-Reposition of brain retractor -After permanent clip: Doppler U/S, reposition of clip -After temporary clip: clip reopening, duration of clipping as short as possible -DCS MEP loss: Ruling out strip electrode displacement and

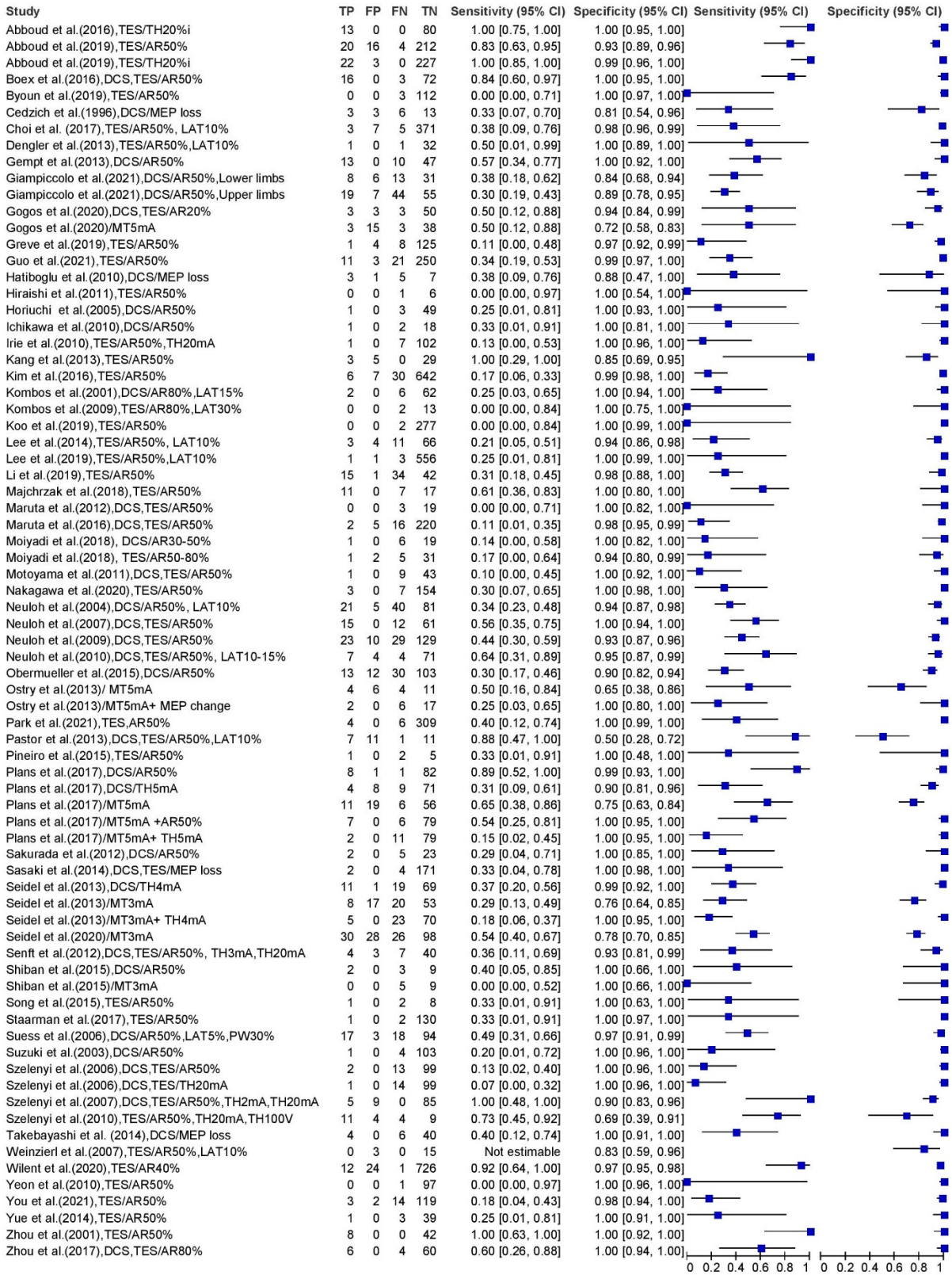
				attempt to elicit MEP with TES
Horiuchi et al.(2005)	LSA and MCA aneurysms (age N/A for all patients)	-DCS -Multi-train (p=5, f=500 Hz,pd=0.2 ms, si=ST+2mA)	Contralateral: thenar	N/A
Suzuki et al. (2003)	ICA(AchA, MCA,PcoA) aneurysms (age N/A for all patients)	-DCS - Multi-train (p=5, f=500 Hz, pd=0.2ms,si= ST+2mA)	Contralateral: thenar	Adjustment of surgical maneuvers
ENDOVASCULAR PROCEDURES FOR ANEURYSMS				
Nakagawa et al.(2020)	Anterior and posterior circulation aneurysms (mean age=61y, SD=14)	-TES -Multi-train (p=5, ISI=2ms, pd= 1.5-2 ms., si=supramaximal)	Bilateral: APB, TA, GAST,AH	-Balloon deflation -Guiding catheter reposition -Intraarterial antithrombotic drug injection -Coil retrieval
Wilent et al.(2020)	aneurysm AVM fistula acute ischemic stroke stenosis vasospasm (average patient age=57.1y)	-TES -N/A simulation parameters	N/A	-Adjustment of instruments -Increase of BP -Active hemostasis -Thrombolysis/ Thrombectomy
Lee et al.(2019)	Cerebral artery aneurysms AVM Arteriovenous/ Carotid-cavernous fistula Stenosis (11–87y, mean age=59.5y)	-TES -Multi-train (p=8, ISI=0.75ms,si=350-450 V)	Bilateral: APB,QUAD,TA,AH	N/A
Piñeiro et al.(2015)	ICA,MCA,BA aneurysms AVM (38-74y)	-TES -Multi-train (p=5-7,ISI=4ms, pd=0.5ms,si≤300V)	Bilateral: APB,TA,AH	-Stop embolization - Optimizing hemodynamic/systemic conditions

Hiraishi et al.(2011)	AChA aneurysms	-TES -Multi-train (p=5, ISI=2ms,si=230-550 V)	BR, APB, AT,AH	Extraction of the coils

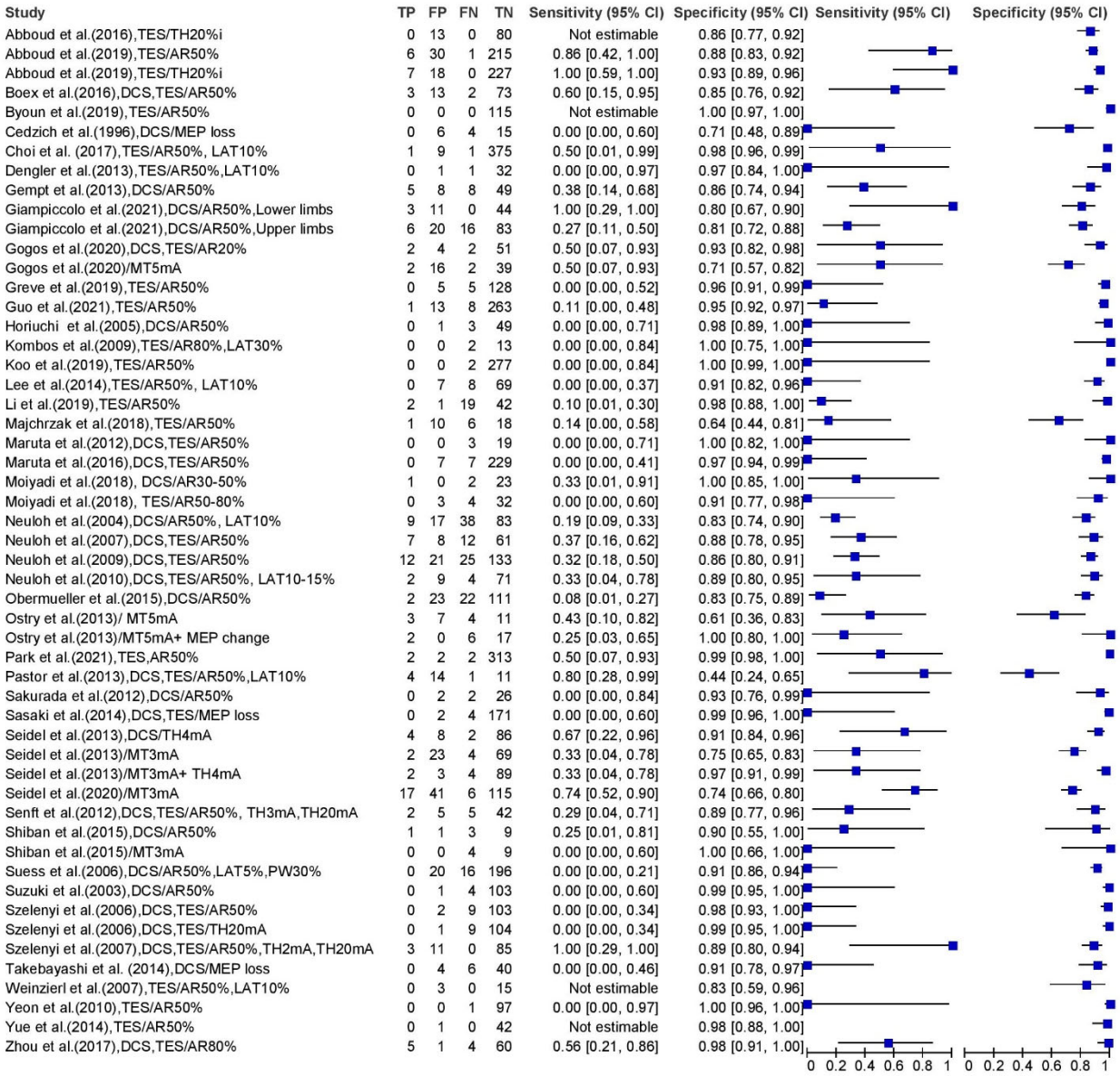
Abbreviations:

ACA: Anterior Cerebral Artery ; **AChA**: Anterior Choroidal Artery ; **AcoA**: Anterior Communicating Artery ; **ADM:**Abductor Digiti Minimi **; ADQ:** Abductor Digiti Quinti ; **AH**:Abductor Hallucis ; **APB:** Abductor Pollicis Brevis ; **AVM**: Arteriovenous Malformation ; **BA:** Basilar Artery ; **BB**:Brachial Biceps ; **bDsCS**: bipolar Direct Subcortical Simulation ; **BP**:Blood Pressure **; BR:**Brachioradialis ; **BT:**Body Temperature ; **CPP**: Cerebral Perfusion Pressure ; **DCS**: Direct Cortical Stimulation; **DELT**:Deltoid ; **DNET:** Dysembryoplastic Neuroepithelial Tumor **ED**:Extensor Digitorum ; **EDB:**Extensor Digitorum Brevis ; **FC:** Flexor Carpi ; **FCR**: Flexor Carpi Radialis ; **FCU:** Flexor Carpi Ulnaris ; **FDS**: Flexor Digitorum Superficialis **; f:**frequency ; **GAST:**Gastrocnemius ; **ICA:**Internal Carotid Artery ; **ISI**: Interstimulus Interval ; **LE**:Lower Extremities ; **LSA:** Lenticulostriate Artery ; **MCA**:Middle Cerebral Artery ; **mDsCS**:monopolar Direct Subcortical Simulation **; MEP:** Motor Evoked Potential ; **N/A:** Not available ; **OO:** Orbicularis Oris ; **p**:Number of pulses ; **PcoA**: Posterior Communicating Artery**; pd:**pulse duration ; **PICA:**Posterior Inferior Cerebellar Artery ; **PL:** Palmaris Longus ; **PMC:**Primary Motor Cortex **; PNET**: Primitive Neuroectodermal Tumor ;**QUAD**:Quadriceps Femoris ; **SCA**:Superior Cerebellar Artery ; **SD:**Standard Deviation ; **SOL:**Soleus ; **ST**: Stimulation Threshold ; **TA:**Tibialis Anterior ; **TES:**Transcranial Electrical Stimulation ; **TRI**:Triceps ; **UE:**Upper Extremities ; **U/S:** ultrasonography ; **VA:**Vertebral Artery ; **y**:years

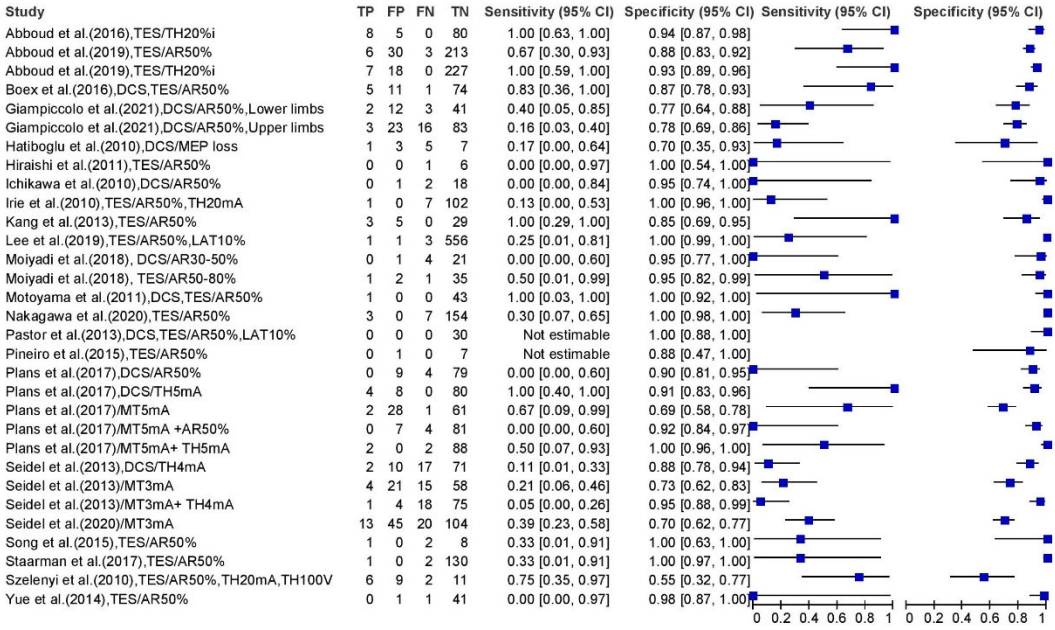
Supplementary Figure S1: Forest plot of sensitivity and specificity estimates for all motor deficits



Supplementary Figure S2: Forest plot of sensitivity and specificity estimates for transient motor deficits

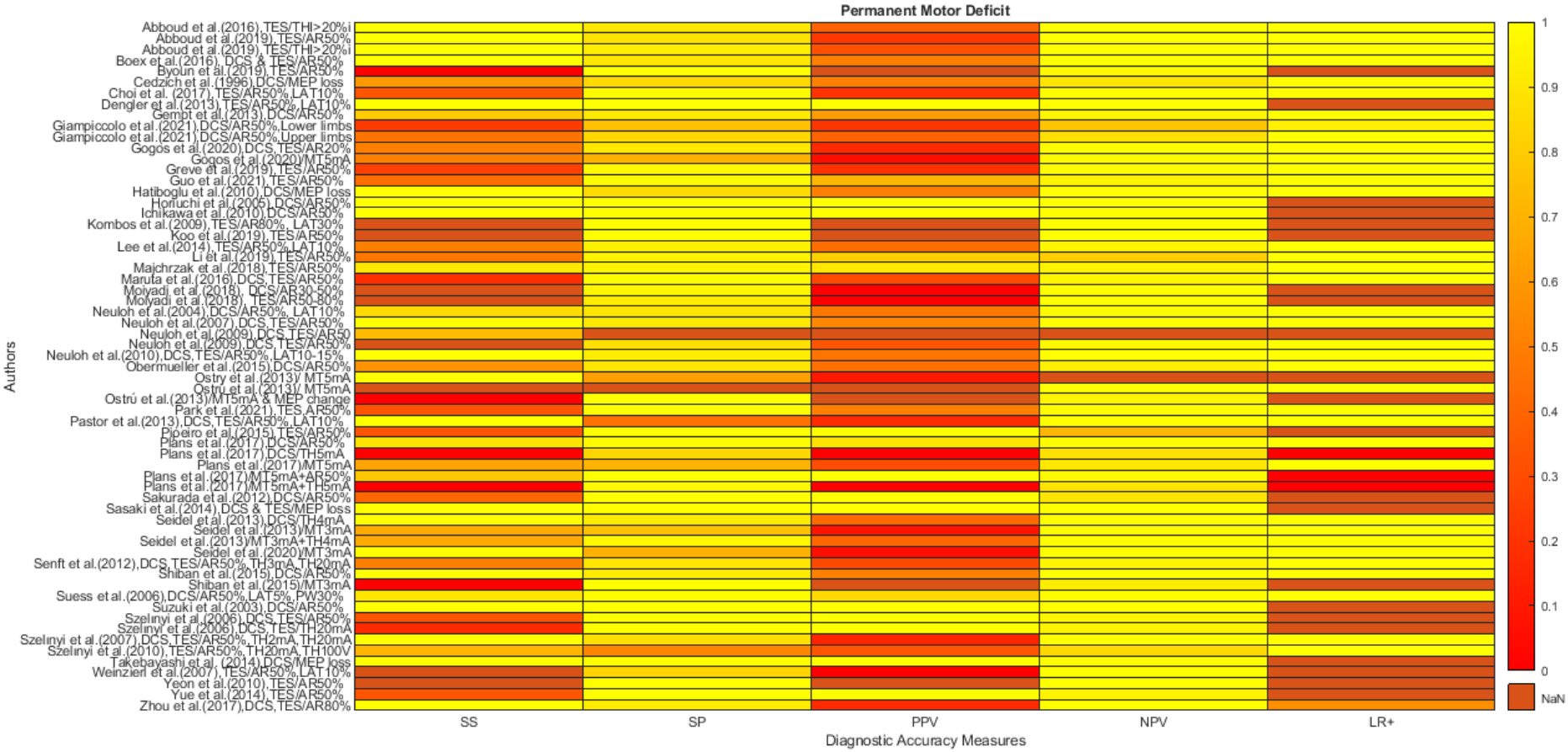


Supplementary Figure S3: Forest plot of sensitivity and specificity estimates for early-transient motor deficits

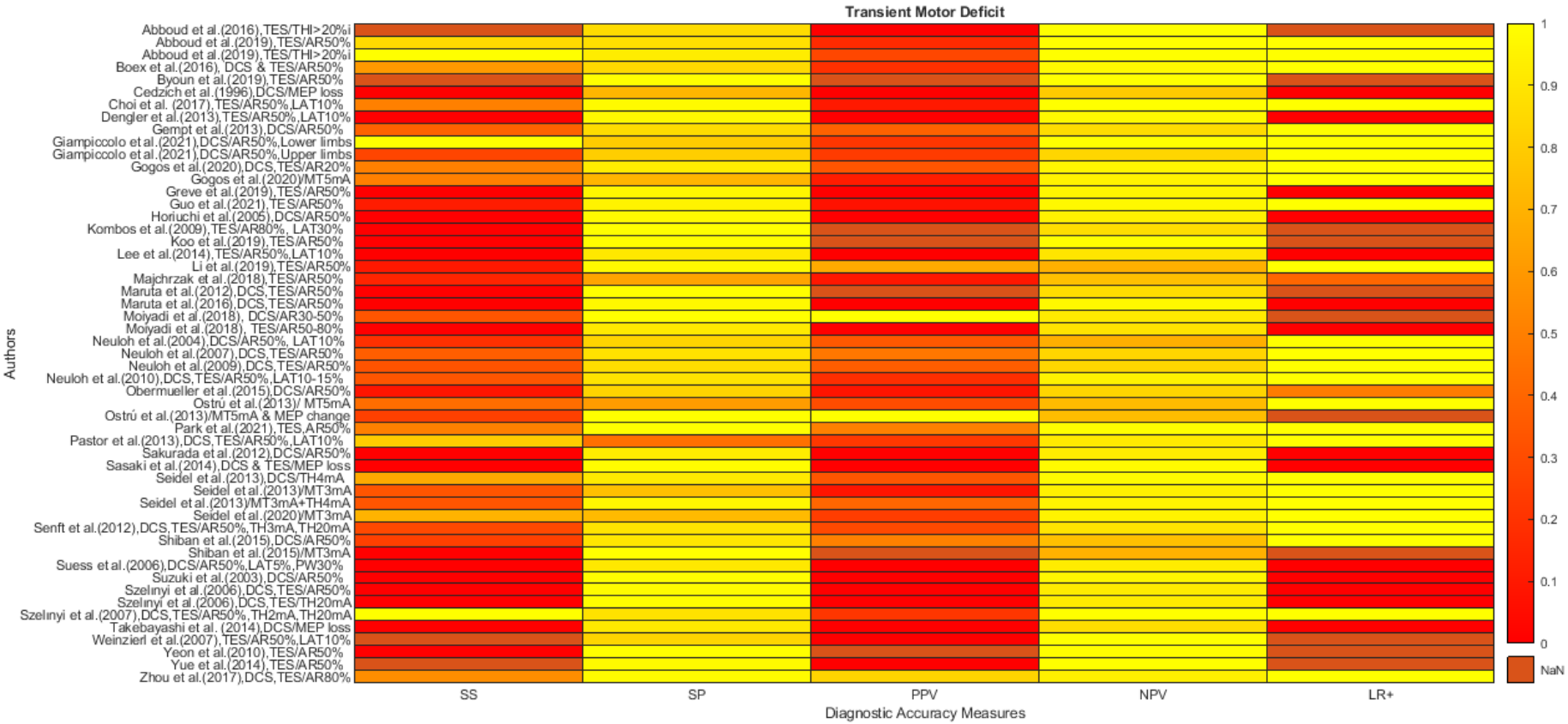


Abbreviations for Supplementary Figures S1,S2 and S3
AR: Amplitude criterion; **DCS:** Direct Cortical Stimulation; **FN:** False Negative; **FP:** False Positive; **i**:ipsilateral ; **LAT:** Latency criterion; **MEP:** Motor Evoked Potential ; **MT:** Motor Threshold/Mapping criterion; **PW:** Pulse Width Increase; **TES:** Transcranial Electrical Stimulation; **TH:** Threshold criterion; **TN:** True Negative; **TP:** True Positive

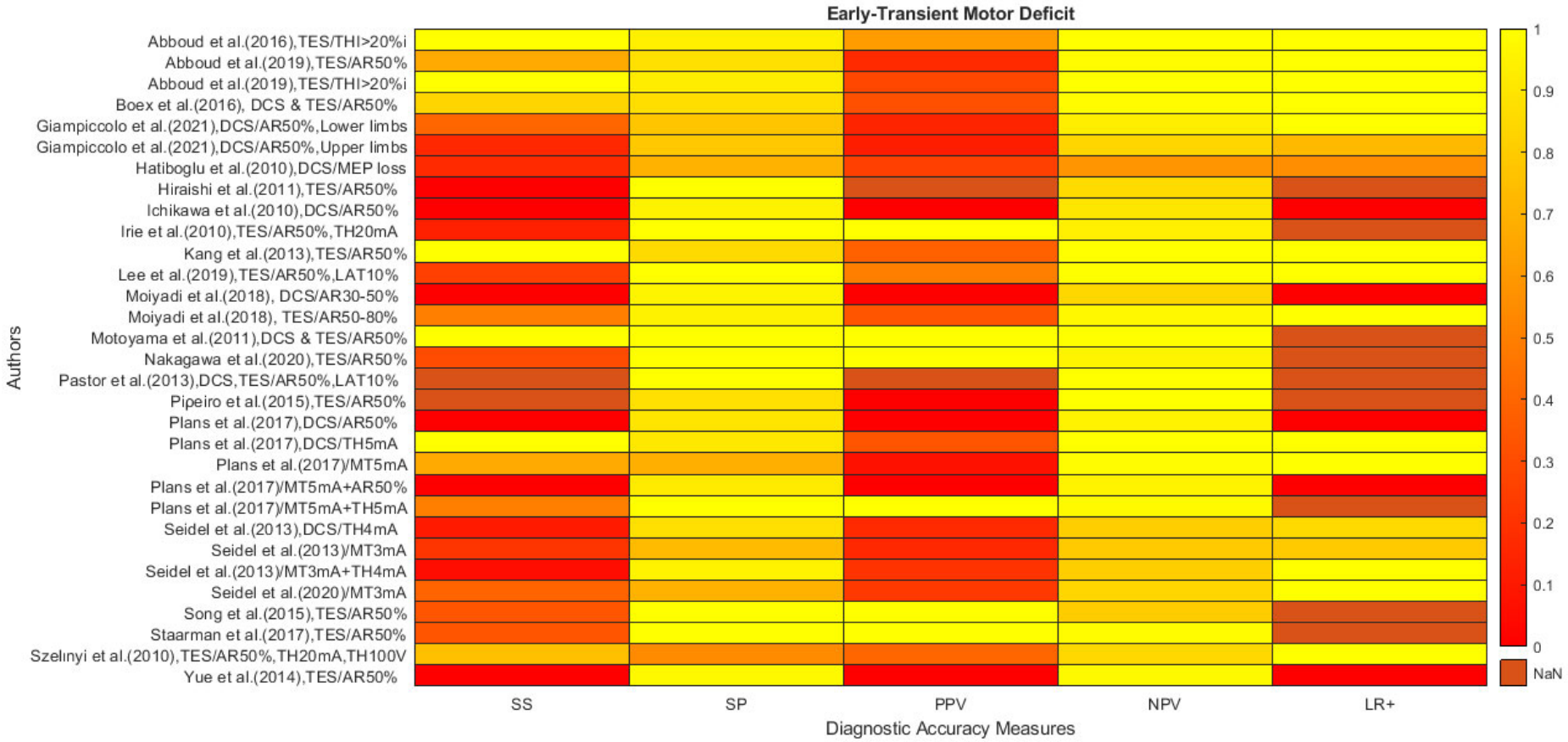
Supplementary Figure S4: Heatmap depicting the diagnostic accuracy measures of MEPs for permanent motor deficits



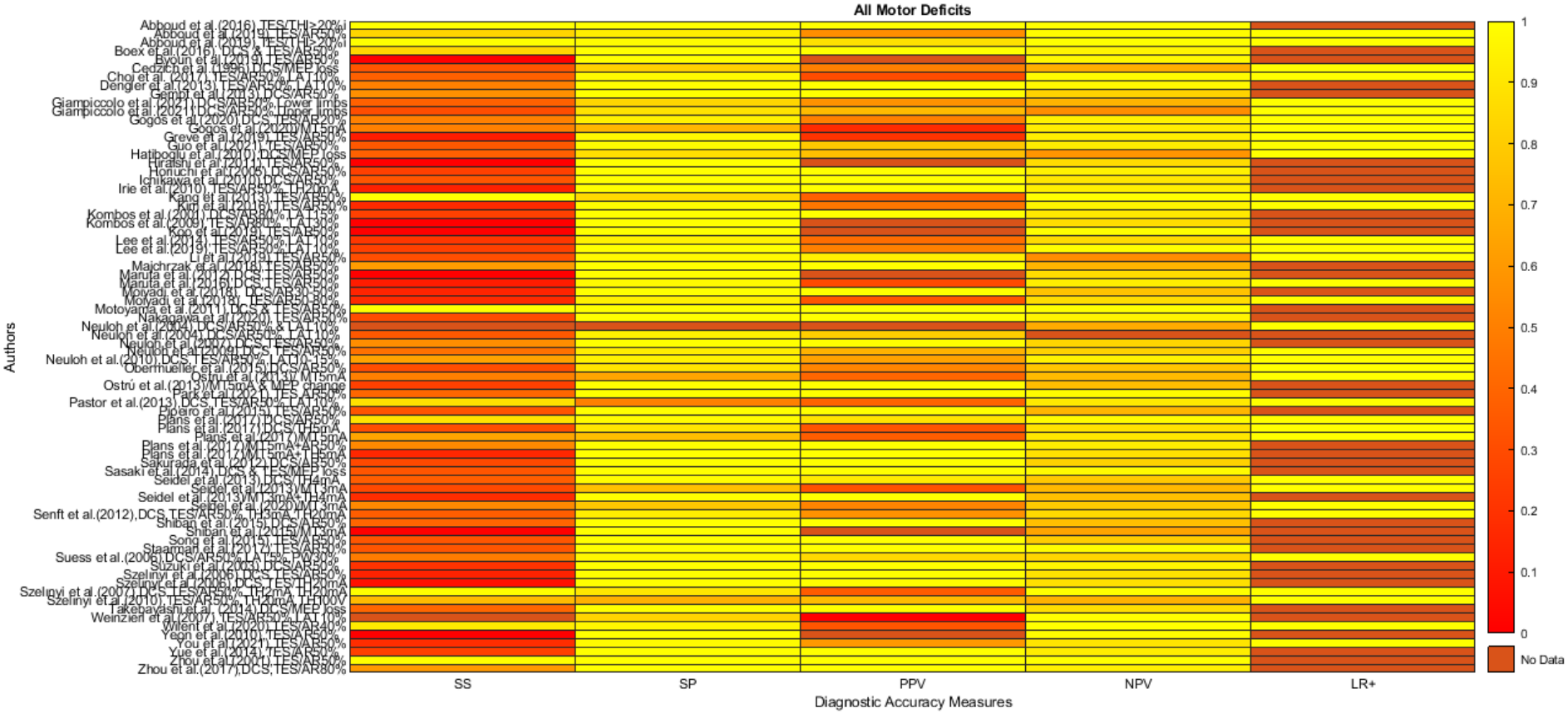
Supplementary Figure S5: Heatmap depicting the diagnostic accuracy measures of MEPs for transient motor deficits



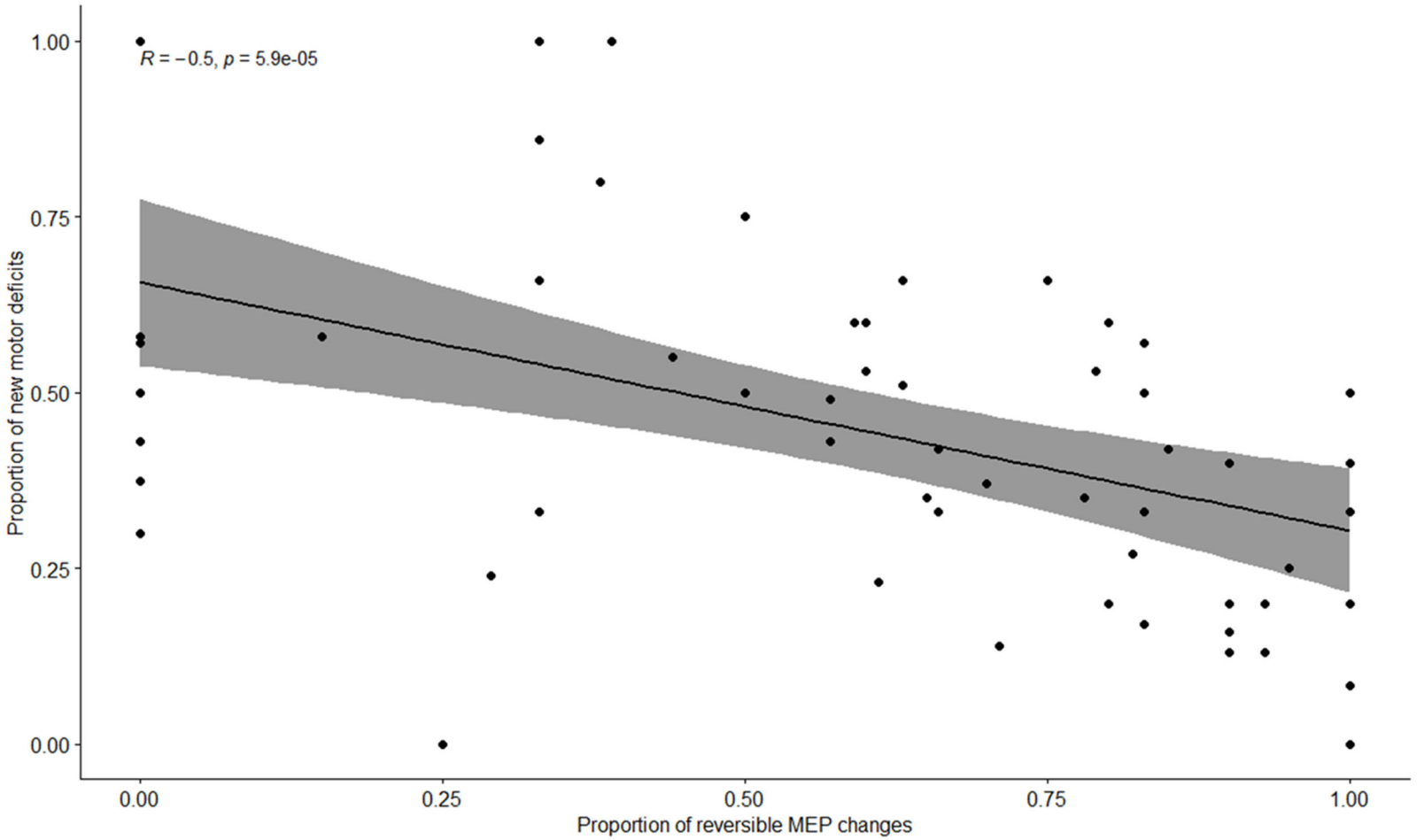
Supplementary Figure S6: Heatmap depicting the diagnostic accuracy measures of MEPs for early-transient motor deficits



Supplementary Figure S7: Heatmap depicting the diagnostic accuracy measures of MEPs for all motor deficits



Abbreviations for Supplementary Figures S4,S5,S6 and S7
AR: Amplitude criterion; **DCS:** Direct Cortical Stimulation; **i:**ipsilateral**; LAT:** Latency criterion; **LR+:**Positive Likelihood Ratio; **MEP:** Motor Evoked Potential **; MT:** Motor Threshold/Mapping criterion; **NaN:** Not available ; **NPV:** Negative Predictive Value; **PPV:** Positive Predictive Value **; PW:** Pulse Width; **SS:** Sensitivity**; SP**: Specificity ; **TES:** Transcranial Electrical Stimulation; **TH:** Threshold criterion



Supplementary Figure S8: Scatterplot with regression line and 95% confidence intervals depicting the negative correlation between the proportion of reversible MEP changes and the proportion of new motor deficits associated with MEP changes. Each dot represents one study. Spearman's rank correlation coefficient= -0.498($p < 0.001$).

Supplementary Table S3: Diagnostic accuracy measures for all postoperative motor deficits

All motor deficits

Authors	DAM	Value
Abboud et al.(2016),TES/THI>20%i	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Abboud et al.(2019),TES/AR50%	SS	0.8333
	SP	0.9298
	PPV	0.5556
	NPV	0.9815
	LR+	11.875
Abboud et al.(2019),TES/THI>20%i	SS	1
	SP	0.9870
	PPV	0.8800
	NPV	1
	LR+	76.666
Boex et al.(2016), DCS & TES/AR50%	SS	0.8421
	SP	1
	PPV	1
	NPV	0.9600
	LR+	N/A
Byoun et al.(2019),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.9739
	LR+	N/A
Cedzich et al.(1996),DCS/MEP loss	SS	0.3333

	SP	0.8125
	PPV	0.5000
	NPV	0.6842
	LR+	1.777
Choi et al. (2017),TES/AR50%,LAT10%	SS	0.3750
	SP	0.9815
	PPV	0.3000
	NPV	0.9867
	LR+	20.250
Dengler et al.(2013),TES/AR50%,LAT10%	SS	0.5000
	SP	1
	PPV	1
	NPV	0.9697
	LR+	N/A
Gempt et al.(2013),DCS/AR50%	SS	0.5652
	SP	1
	PPV	1
	NPV	0.8246
	LR+	N/A
Giampiccolo et al.(2021),DCS/AR50%,Upper limbs	SS	0.3016
	SP	0.8871
	PPV	0.7308
	NPV	0.5556
	LR+	2.671
Giampiccolo et al.(2021),DCS/AR50%,Lower limbs	SS	0.3810
	SP	0.8378
	PPV	0.5714
	NPV	0.7045
	LR+	2.349
Gogos et al.(2020),DCS,TES/AR20%	SS	0.5000
	SP	0.9434

	PPV	0.5000
	NPV	0.9434
	LR+	8.833
Gogos et al.(2020)/MT5mA	SS	0.5000
	SP	0.7170
	PPV	0.1667
	NPV	0.9268
	LR+	1.766
Greve et al.(2019),TES/AR50%	SS	0.1111
	SP	0.9690
	PPV	0.2000
	NPV	0.9398
	LR+	3.583
Guo et al.(2021),TES/AR50%	SS	0.3438
	SP	0.9881
	PPV	0.7857
	NPV	0.9225
	LR+	28.989
Hatiboglu et al.(2010),DCS/MEP loss	SS	0.3750
	SP	0.8750
	PPV	0.7500
	NPV	0.5833
	LR+	3.000
Hiraishi et al.(2011),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.8571
	LR+	N/A
Horiuchi et al.(2005),DCS/AR50%	SS	0.2500
	SP	1
	PPV	1

	NPV	0.9423
	LR+	N/A
Ichikawa et al.(2010),DCS/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.9000
	LR+	N/A
Irie et al.(2010),TES/AR50%,TH20mA	SS	0.1250
	SP	1
	PPV	1
	NPV	0.9358
	LR+	N/A
Kang et al.(2013),TES/AR50%	SS	1
	SP	0.8529
	PPV	0.3750
	NPV	1
	LR+	6.800
Kim et al.(2016),TES/AR50%	SS	0.1667
	SP	0.9892
	PPV	0.4615
	NPV	0.9554
	LR+	15.452
Kombos et al.(2001),DCS/AR80%,LAT15%	SS	0.2500
	SP	1
	PPV	1
	NPV	0.9118
	LR+	N/A
Kombos et al.(2009),TES/AR80%, LAT30%	SS	0
	SP	1
	PPV	N/A
	NPV	0.8667

	LR+	N/A
Koo et al.(2019),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.9928
	LR+	N/A
Lee et al.(2014),TES/AR50%,LAT10%	SS	0.2143
	SP	0.9429
	PPV	0.4286
	NPV	0.8571
	LR+	3.750
Lee et al.(2019),TES/AR50%,LAT10%	SS	0.2500
	SP	0.9982
	PPV	0.5000
	NPV	0.9946
	LR+	139.250
Li et al.(2019),TES/AR50%	SS	0.3061
	SP	0.9767
	PPV	0.9375
	NPV	0.5526
	LR+	13.163
Majchrzak et al.(2018),TES/AR50%	SS	0.6111
	SP	1
	PPV	1
	NPV	0.7083
	LR+	N/A
Maruta et al.(2012),DCS,TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.8636
	LR+	N/A

Maruta et al.(2016),DCS,TES/AR50%	SS	0.1111
	SP	0.9778
	PPV	0.2857
	NPV	0.9322
	LR+	5.000
Moiyadi et al.(2018), DCS/AR30-50%	SS	0.1429
	SP	1
	PPV	1
	NPV	0.7600
	LR+	N/A
Moiyadi et al.(2018), TES/AR50-80%	SS	0.1667
	SP	0.9394
	PPV	0.3333
	NPV	0.8611
	LR+	2.750
Motoyama et al.(2011),DCS & TES/AR50%	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Nakagawa et al.(2020),TES/AR50%	SS	0.3000
	SP	1
	PPV	1
	NPV	0.9565
	LR+	N/A
Neuloh et al.(2004),DCS/AR50%, LAT10%	SS	0.3443
	SP	0.9419
	PPV	0.8077
	NPV	0.6694
	LR+	5.921
Neuloh et al.(2007),DCS,TES/AR50%	SS	0.5556

	SP	1
	PPV	1
	NPV	0.8356
	LR+	N/A
Neuloh et al.(2009),DCS,TES/AR50%	SS	0.4423
	SP	0.9281
	PPV	0.6970
	NPV	0.8165
	LR+	6.148
Neuloh et al.(2010),DCS,TES/AR50%,LAT10-15%	SS	0.6364
	SP	0.9467
	PPV	0.6364
	NPV	0.9467
	LR+	11.931
Obermueller et al.(2015),DCS/AR50%	SS	0.3023
	SP	0.8957
	PPV	0.5200
	NPV	0.7744
	LR+	2.897
Ostrý et al.(2013)/ MT5mA	SS	0.5000
	SP	0.6471
	PPV	0.4000
	NPV	0.7333
	LR+	1.416
Ostrý et al.(2013)/MT5mA & MEP change	SS	0.2500
	SP	1
	PPV	1
	NPV	0.7391
	LR+	N/A
Park et al.(2021),TES,AR50%	SS	0.4000
	SP	1

	PPV	1
	NPV	0.9810
	LR+	N/A
Pastor et al.(2013),DCS,TES/AR50%,LAT10%	SS	0.8750
	SP	0.5000
	PPV	0.3889
	NPV	0.9167
	LR+	1.750
Piñeiro et al.(2015),TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.7143
	LR+	N/A
Plans et al.(2017),DCS/AR50%	SS	0.8889
	SP	0.9880
	PPV	0.8889
	NPV	0.9880
	LR+	73.777
Plans et al.(2017),DCS/TH5mA	SS	0.3077
	SP	0.8987
	PPV	0.3333
	NPV	0.8875
	LR+	3.038
Plans et al.(2017)/MT5mA	SS	0.6471
	SP	0.7467
	PPV	0.3667
	NPV	0.9032
	LR+	2.554
Plans et al.(2017)/MT5mA+AR50%	SS	0.5385
	SP	1
	PPV	1

	NPV	0.9294
	LR+	N/A
Plans et al.(2017)/MT5mA+TH5mA	SS	0.1538
	SP	1
	PPV	1
	NPV	0.8778
	LR+	N/A
Sakurada et al.(2012),DCS/AR50%	SS	0.2857
	SP	1
	PPV	1
	NPV	0.8214
	LR+	N/A
Sasaki et al.(2014),DCS & TES/MEP loss	SS	0.3333
	SP	1
	PPV	1
	NPV	0.9771
	LR+	N/A
Seidel et al.(2013),DCS/TH4mA	SS	0.3667
	SP	0.9857
	PPV	0.9167
	NPV	0.7841
	LR+	25.666
Seidel et al.(2013)/MT3mA	SS	0.2857
	SP	0.7571
	PPV	0.3200
	NPV	0.7260
	LR+	1.176
Seidel et al.(2013)/MT3mA+TH4mA	SS	0.1786
	SP	1
	PPV	1
	NPV	0.7527

	LR+	N/A
Seidel et al.(2020)/MT3mA	SS	0.5357
	SP	0.7778
	PPV	0.5172
	NPV	0.7903
	LR+	2.410
Senft et al.(2012),DCS,TES/AR50%,TH3mA,TH20mA	SS	0.3636
	SP	0.9302
	PPV	0.5714
	NPV	0.8511
	LR+	5.212
Shiban et al.(2015),DCS/AR50%	SS	0.4000
	SP	1
	PPV	1
	NPV	0.7500
	LR+	N/A
Shiban et al.(2015)/MT3mA	SS	0
	SP	1
	PPV	N/A
	NPV	0.6429
	LR+	N/A
Song et al.(2015),TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.8000
	LR+	N/A
Staarman et al.(2017),TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.9848
	LR+	N/A

Suess et al.(2006),DCS/AR50%,LAT5%,PW30%	SS	0.4857
	SP	0.9691
	PPV	0.8500
	NPV	0.8393
	LR+	15.704
Suzuki et al.(2003),DCS/AR50%	SS	0.2000
	SP	1
	PPV	1
	NPV	0.9626
	LR+	N/A
Szelényi et al.(2006),DCS,TES/AR50%	SS	0.1333
	SP	1
	PPV	1
	NPV	0.8839
	LR+	N/A
Szelényi et al.(2006),DCS,TES/TH20mA	SS	0.0667
	SP	1
	PPV	1
	NPV	0.8761
	LR+	N/A
Szelényi et al.(2007),DCS,TES/AR50%,TH2mA,TH20mA	SS	1
	SP	0.9043
	PPV	0.3571
	NPV	1
	LR+	10.444
Szelényi et al.(2010),TES/AR50%,TH20mA,TH100V	SS	0.7333
	SP	0.6923
	PPV	0.7333
	NPV	0.6923
	LR+	2.383

Takebayashi et al. (2014),DCS/MEP loss	SS	0.4000
	SP	1
	PPV	1
	NPV	0.8696
	LR+	N/A
Weinzierl et al.(2007),TES/AR50%,LAT10%	SS	N/A
	SP	0.8333
	PPV	0
	NPV	1
	LR+	N/A
Wilent et al.(2020),TES/AR40%	SS	0.9231
	SP	0.9680
	PPV	0.3333
	NPV	0.9986
	LR+	28.846
Yeon et al.(2010),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.9898
	LR+	N/A
You et al.(2021),TES/AR50%	SS	0.1765
	SP	0.9835
	PPV	0.6000
	NPV	0.8947
	LR+	10.676
Yue et al.(2014),TES/AR50%	SS	0.2500
	SP	1
	PPV	1
	NPV	0.9286
	LR+	N/A
Zhou et al.(2001),TES/AR50%	SS	1

	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Zhou et al.(2017),DCS,TES/AR80%	SS	0.6000
	SP	1
	PPV	1
	NPV	0.9375
	LR+	N/A

Supplementary Table S4: Diagnostic accuracy measures for permanent postoperative motor deficits

Permanent motor deficit		
Authors	**DAM**	**Value**
Abboud et al.(2016),TES/THI>20%i	SS	1
	SP	0.9091
	PPV	0.3846
	NPV	1
	LR+	11
Abboud et al.(2019),TES/AR50%	SS	1
	SP	0.8852
	PPV	0.2222
	NPV	1
	LR+	8.714
Abboud et al.(2019),TES/THI>20%i	SS	1
	SP	0.9303
	PPV	0.3200
	NPV	1
	LR+	14.352
Boex et al.(2016), DCS & TES/AR50%	SS	1
	SP	0.9036

	PPV	0.5000
	NPV	1
	LR+	10.375
Byoun et al.(2019),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.9739
	LR+	N/A
Cedzich et al.(1996),DCS/MEP loss	SS	0.6000
	SP	0.8500
	PPV	0.5000
	NPV	0.8947
	LR+	4.000
Choi et al. (2017),TES/AR50%,LAT10%	SS	0.3333
	SP	0.9789
	PPV	0.2000
	NPV	0.9894
	LR+	15.833
Dengler et al.(2013),TES/AR50%,LAT10%	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Gempt et al.(2013),DCS/AR50%	SS	0.8000
	SP	0.9167
	PPV	0.6154
	NPV	0.9649
	LR+	9.600
Giampiccolo et al.(2021),DCS/AR50%,Upper limbs	SS	0.4545
	SP	0.8447
	PPV	0.3846

	NPV	0.8788
	LR+	2.926
Giampiccolo et al.(2021),DCS/AR50%,Lower limbs	SS	0.2308
	SP	0.7556
	PPV	0.2143
	NPV	0.7727
	LR+	0.9441
Gogos et al.(2020),DCS,TES/AR20%	SS	0.5000
	SP	0.9123
	PPV	0.1667
	NPV	0.9811
	LR+	5.700
Gogos et al.(2020)/MT5mA	SS	0.5000
	SP	0.7018
	PPV	0.0556
	NPV	0.9756
	LR+	1.676
Greve et al.(2019),TES/AR50%	SS	0.2500
	SP	0.9701
	PPV	0.2000
	NPV	0.9774
	LR+	8.375
Guo et al.(2021),TES/AR50%	SS	0.4348
	SP	0.9847
	PPV	0.7143
	NPV	0.9520
	LR+	28.478
Hatiboglu et al.(2010),DCS/MEP loss	SS	1
	SP	0.8571
	PPV	0.5000
	NPV	1

	LR+	7.000
Horiuchi et al.(2005),DCS/AR50%	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Ichikawa et al.(2010),DCS/AR50%	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Kombos et al.(2009),TES/AR80%, LAT30%	SS	N/A
	SP	1
	PPV	N/A
	NPV	1
	LR+	N/A
Koo et al.(2019),TES/AR50%	SS	N/A
	SP	1
	PPV	N/A
	NPV	1
	LR+	N/A
Lee et al.(2014),TES/AR50%,LAT10%	SS	0.5000
	SP	0.9487
	PPV	0.4286
	NPV	0.9610
	LR+	9.750
Li et al.(2019),TES/AR50%	SS	0.4643
	SP	0.9531
	PPV	0.8125
	NPV	0.8026
	LR+	9.904

Majchrzak et al.(2018),TES/AR50%	SS	0.9091
	SP	0.9583
	PPV	0.9091
	NPV	0.9583
	LR+	21.818
Maruta et al.(2016),DCS,TES/AR50%	SS	0.1818
	SP	0.9784
	PPV	0.2857
	NPV	0.9619
	LR+	8.436
Moiyadi et al.(2018), DCS/AR30-50%	SS	N/A
	SP	0.9615
	PPV	0
	NPV	1
	LR+	N/A
Moiyadi et al.(2018), TES/AR50-80%	SS	N/A
	SP	0.9231
	PPV	0
	NPV	1
	LR+	N/A
Neuloh et al.(2004),DCS/AR50%, LAT10%	SS	0.8571
	SP	0.8947
	PPV	0.4615
	NPV	0.9835
	LR+	8.142
Neuloh et al.(2007),DCS,TES/AR50%	SS	1
	SP	0.9125
	PPV	0.5333
	NPV	1
	LR+	11.428
Neuloh et al.(2009),DCS,TES/AR50	SS	0.7333

	SP	0.8750
	PPV	0.3333
	NPV	0.9747
	LR+	5.866
Neuloh et al.(2010),DCS,TES/AR50%,LAT10-15%	SS	1
	SP	0.9259
	PPV	0.4545
	NPV	1
	LR+	13.500
Obermueller et al.(2015),DCS/AR50%	SS	0.5789
	SP	0.8993
	PPV	0.4400
	NPV	0.9398
	LR+	5.748
Ostry et al.(2013)/ MT5mA	SS	1
	SP	0.6250
	PPV	0.1000
	NPV	1
	LR+	2.666
Ostrý et al.(2013)/MT5mA & MEP change	SS	0
	SP	1
	PPV	N/A
	NPV	0.9600
	LR+	N/A
Park et al.(2021),TES,AR50%	SS	0.3333
	SP	0.9936
	PPV	0.5000
	NPV	0.9873
	LR+	52.166
Pastor et al.(2013),DCS,TES/AR50%,LAT10%	SS	1
	SP	0.4444

	PPV	0.1667
	NPV	1
	LR+	1.800
Piñeiro et al.(2015),TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.7143
	LR+	N/A
Plans et al.(2017),DCS/AR50%	SS	0.8889
	SP	0.9868
	PPV	0.8889
	NPV	0.9868
	LR+	67.555
Plans et al.(2017),DCS/TH5mA	SS	0
	SP	0.8421
	PPV	0
	NPV	0.8767
	LR+	0
Plans et al.(2017)/MT5mA	SS	0.6429
	SP	0.7042
	PPV	0.3000
	NPV	0.9091
	LR+	2.173
Plans et al.(2017)/MT5mA+AR50%	SS	0.7778
	SP	1
	PPV	1
	NPV	0.9744
	LR+	0
Plans et al.(2017)/MT5mA+TH5mA	SS	0
	SP	0.9737
	PPV	0

	NPV	0.8916
	LR+	0
Sakurada et al.(2012),DCS/AR50%	SS	0.4000
	SP	1
	PPV	1
	NPV	0.8929
	LR+	N/A
Sasaki et al.(2014),DCS & TES/MEP loss	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Seidel et al.(2013),DCS/TH4mA	SS	1
	SP	0.9263
	PPV	0.4167
	NPV	1
	LR+	13.571
Seidel et al.(2013)/MT3mA	SS	0.6667
	SP	0.7579
	PPV	0.0800
	NPV	0.9863
	LR+	2.753
Seidel et al.(2013)/MT3mA+TH4mA	SS	0.6667
	SP	0.9684
	PPV	0.4000
	NPV	0.9892
	LR+	21.111
Seidel et al.(2020)/MT3mA	SS	1
	SP	0.6927
	PPV	0.0517
	NPV	1

	LR+	3.200
Senft et al.(2012),DCS,TES/AR50%,TH3mA,TH20mA	SS	0.5000
	SP	0.9000
	PPV	0.2857
	NPV	0.9574
	LR+	5.000
Shiban et al.(2015),DCS/AR50%	SS	1
	SP	0.9231
	PPV	0.5000
	NPV	1
	LR+	13.000
Shiban et al.(2015)/MT3mA	SS	0
	SP	1
	PPV	N/A
	NPV	0.9286
	LR+	N/A
Suess et al.(2006),DCS/AR50%,LAT5%,PW30%	SS	0.8947
	SP	0.9859
	PPV	0.8500
	NPV	0.9906
	LR+	63.526
Suzuki et al.(2003),DCS/AR50%	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Szelényi et al.(2006),DCS,TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.9643
	LR+	N/A

Szelényi et al.(2006),DCS,TES/TH20mA	SS	0.1667
	SP	1
	PPV	1
	NPV	0.9558
	LR+	N/A
Szelényi et al.(2007),DCS,TES/AR50%,TH2mA,TH20mA	SS	1
	SP	0.8763
	PPV	0.1429
	NPV	1
	LR+	8.083
Szelényi et al.(2010),TES/AR50%,TH20mA,TH100V	SS	0.7143
	SP	0.5238
	PPV	0.3333
	NPV	0.8462
	LR+	1.500
Takebayashi et al. (2014),DCS/MEP loss	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Weinzierl et al.(2007),TES/AR50%,LAT10%	SS	N/A
	SP	0.8333
	PPV	0
	NPV	1
	LR+	N/A
Yeon et al.(2010),TES/AR50%	SS	N/A
	SP	1
	PPV	N/A
	NPV	1
	LR+	N/A

Yue et al.(2014),TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.9524
	LR+	N/A
Zhou et al.(2017),DCS,TES/AR80%	SS	1
	SP	0.9275
	PPV	0.1667
	NPV	1
	LR+	0.5556

Supplementary Table S5: Diagnostic accuracy measures for transient postoperative motor deficits

Authors	**DAM**	**Value**
Abboud et al.(2016),TES/THI>20%i	SS	N/A
	SP	0.8602
	PPV	0
	NPV	1
	LR+	N/A
Abboud et al.(2019),TES/AR50%	SS	0.8571
	SP	0.8776
	PPV	0.1667
	NPV	0.9954
	LR+	7.000
Abboud et al.(2019),TES/THI>20%i	SS	1
	SP	0.9265
	PPV	0.2800

	NPV	1
	LR+	13.611
Boex et al.(2016), DCS & TES/AR50%	SS	0.6000
	SP	0.8488
	PPV	0.1875
	NPV	0.9733
	LR+	3.969
Byoun et al.(2019),TES/AR50%	SS	N/A
	SP	1
	PPV	N/A
	NPV	1
	LR+	N/A
Cedzich et al.(1996),DCS/MEP loss	SS	0
	SP	0.7143
	PPV	0
	NPV	0.7895
	LR+	0
Choi et al. (2017),TES/AR50%,LAT10%	SS	0.5000
	SP	0.9766
	PPV	0.1000
	NPV	0.9973
	LR+	21.333
Dengler et al.(2013),TES/AR50%,LAT10%	SS	0
	SP	0.9697
	PPV	0
	NPV	0.9697
	LR+	0
Gempt et al.(2013),DCS/AR50%	SS	0.3846
	SP	0.8596
	PPV	0.3846
	NPV	0.8596

	LR+	2.740
Giampiccolo et al.(2021),DCS/AR50%,Upper limbs	SS	0.2727
	SP	0.8058
	PPV	0.2308
	NPV	0.8384
	LR+	1.404
Giampiccolo et al.(2021),DCS/AR50%,Lower limbs	SS	1
	SP	0.8000
	PPV	0.2143
	NPV	1
	LR+	5.000
Gogos et al.(2020),DCS,TES/AR20%	SS	0.5000
	SP	0.9273
	PPV	0.3333
	NPV	0.9623
	LR+	6.875
Gogos et al.(2020)/MT5mA	SS	0.5000
	SP	0.7091
	PPV	0.1111
	NPV	0.9512
	LR+	1.718
Greve et al.(2019),TES/AR50%	SS	0
	SP	0.9624
	PPV	0
	NPV	0.9624
	LR+	0
Guo et al.(2021),TES/AR50%	SS	0.1111
	SP	0.9529
	PPV	0.0714
	NPV	0.9705
	LR+	2.359

Horiuchi et al.(2005),DCS/AR50%	SS	0
	SP	0.9800
	PPV	0
	NPV	0.9423
	LR+	0
Kombos et al.(2009),TES/AR80%, LAT30%	SS	0
	SP	1
	PPV	N/A
	NPV	0.8667
	LR+	N/A
Koo et al.(2019),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.9928
	LR+	N/A
Lee et al.(2014),TES/AR50%,LAT10%	SS	0
	SP	0.9079
	PPV	0
	NPV	0.8961
	LR+	0
Li et al.(2019),TES/AR50%	SS	0.0952
	SP	0.9767
	PPV	0.6667
	NPV	0.6885
	LR+	4.095
Majchrzak et al.(2018),TES/AR50%	SS	0.1429
	SP	0.6429
	PPV	0.0909
	NPV	0.7500
	LR+	0.400
Maruta et al.(2012),DCS,TES/AR50%	SS	0

	SP	1
	PPV	N/A
	NPV	0.8636
	LR+	N/A
Maruta et al.(2016),DCS,TES/AR50%	SS	0
	SP	0.9703
	PPV	0
	NPV	0.9703
	LR+	0
Moiyadi et al.(2018), DCS/AR30-50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.9200
	LR+	N/A
Moiyadi et al.(2018), TES/AR50-80%	SS	0
	SP	0.9143
	PPV	0
	NPV	0.8889
	LR+	0
Neuloh et al.(2004),DCS/AR50%, LAT10%	SS	0.1915
	SP	0.8300
	PPV	0.3462
	NPV	0.6860
	LR+	1.126
Neuloh et al.(2007),DCS,TES/AR50%	SS	0.3684
	SP	0.8841
	PPV	0.4667
	NPV	0.8356
	LR+	3.177
Neuloh et al.(2009),DCS,TES/AR50%	SS	0.3243
	SP	0.8636

	PPV	0.3636
	NPV	0.8418
	LR+	2.378
Neuloh et al.(2010),DCS,TES/AR50%,LAT10-15%	SS	0.3333
	SP	0.8875
	PPV	0.1818
	NPV	0.9467
	LR+	2.963
Obermueller et al.(2015),DCS/AR50%	SS	0.0833
	SP	0.8284
	PPV	0.0800
	NPV	0.8346
	LR+	0.4855
Ostrý et al.(2013)/ MT5mA	SS	0.4286
	SP	0.6111
	PPV	0.3000
	NPV	0.7333
	LR+	1.102
Ostrý et al.(2013)/MT5mA & MEP change	SS	0.2500
	SP	1
	PPV	1
	NPV	0.7391
	LR+	N/A
Park et al.(2021),TES,AR50%	SS	0.5000
	SP	0.9937
	PPV	0.5000
	NPV	0.9937
	LR+	78.750
Pastor et al.(2013),DCS,TES/AR50%,LAT10%	SS	0.8000
	SP	0.4400
	PPV	0.2222

	NPV	0.9167
	LR+	1.428
Sakurada et al.(2012),DCS/AR50%	SS	0
	SP	0.9286
	PPV	0
	NPV	0.9286
	LR+	0
Sasaki et al.(2014),DCS & TES/MEP loss	SS	0
	SP	0.9884
	PPV	0
	NPV	0.9771
	LR+	0
Seidel et al.(2013),DCS/TH4mA	SS	0.6667
	SP	0.9149
	PPV	0.3333
	NPV	0.9773
	LR+	7.833
Seidel et al.(2013)/MT3mA	SS	0.3333
	SP	0.7500
	PPV	0.0800
	NPV	0.9452
	LR+	1.333
Seidel et al.(2013)/MT3mA+TH4mA	SS	0.3333
	SP	0.9674
	PPV	0.4000
	NPV	0.9570
	LR+	10.222
Seidel et al.(2020)/MT3mA	SS	0.7000
	SP	0.7284
	PPV	0.2414
	NPV	0.9516

	LR+	2.812
Senft et al.(2012),DCS,TES/AR50%,TH3mA,TH20mA	SS	0.2857
	SP	0.8936
	PPV	0.2857
	NPV	0.8936
	LR+	2.685
Shiban et al.(2015),DCS/AR50%	SS	0.2500
	SP	0.9000
	PPV	0.5000
	NPV	0.7500
	LR+	2.500
Shiban et al.(2015)/MT3mA	SS	0
	SP	1
	PPV	N/A
	NPV	0.6923
	LR+	N/A
Suess et al.(2006),DCS/AR50%,LAT5%,PW30%	SS	0
	SP	0.9074
	PPV	0
	NPV	0.9245
	LR+	0
Suzuki et al.(2003),DCS/AR50%	SS	0
	SP	0.9904
	PPV	0
	NPV	0.9626
	LR+	0
Szelényi et al.(2006),DCS,TES/AR50%	SS	0
	SP	0.9810
	PPV	0
	NPV	0.9196
	LR+	0

Szelényi et al.(2006),DCS,TES/TH20mA	SS	0
	SP	0.9905
	PPV	0
	NPV	0.9204
	LR+	0
Szelényi et al.(2007),DCS,TES/AR50%,TH2mA,TH20mA	SS	1
	SP	0.8854
	PPV	0.2143
	NPV	1
	LR+	8.727
Takebayashi et al. (2014),DCS/MEP loss	SS	0
	SP	0.9091
	PPV	0
	NPV	0.8696
	LR+	0
Weinzierl et al.(2007),TES/AR50%,LAT10%	SS	N/A
	SP	0.8333
	PPV	0
	NPV	1
	LR+	N/A
Yeon et al.(2010),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.9898
	LR+	N/A
Yue et al.(2014),TES/AR50%	SS	N/A
	SP	0.9767
	PPV	0
	NPV	1
	LR+	N/A

Zhou et al.(2017),DCS,TES/AR80%	SS	0.5556
	SP	0.9836
	PPV	0.8333
	NPV	0.9375
	LR+	33.888

Supplementary Table S6: Diagnostic accuracy measures for early-transient postoperative motor deficits

Authors	**DAM**	**Value**
Abboud et al.(2016),TES/THI>20%i	SS	1
	SP	0.9412
	PPV	0.6154
	NPV	1
	LR+	17.000
Abboud et al.(2019),TES/AR50%	SS	0.6667
	SP	0.8765
	PPV	0.1667
	NPV	0.9861
	LR+	5.400
Abboud et al.(2019),TES/THI>20%i	SS	1
	SP	0.9265
	PPV	0.2800
	NPV	1
	LR+	13.611
Boex et al.(2016), DCS & TES/AR50%	SS	0.8333
	SP	0.8706
	PPV	0.3125

	NPV	0.9867
	LR+	6.439
Giampiccolo et al.(2021),DCS/AR50%,Upper limbs	SS	0.1579
	SP	0.7830
	PPV	0.1154
	NPV	0.8384
	LR+	0.727
Giampiccolo et al.(2021),DCS/AR50%,Lower limbs	SS	0.4000
	SP	0.7736
	PPV	0.1429
	NPV	0.9318
	LR+	1.766
Hatiboglu et al.(2010),DCS/MEP loss	SS	0.1667
	SP	0.7000
	PPV	0.2500
	NPV	0.5833
	LR+	0.555
Hiraishi et al.(2011),TES/AR50%	SS	0
	SP	1
	PPV	N/A
	NPV	0.8571
	LR+	N/A
Ichikawa et al.(2010),DCS/AR50%	SS	0
	SP	0.9474
	PPV	0
	NPV	0.9000
	LR+	0
Irie et al.(2010),TES/AR50%,TH20mA	SS	0.1250
	SP	1
	PPV	1
	NPV	0.9358

	LR+	N/A
Kang et al.(2013),TES/AR50%	SS	1
	SP	0.8529
	PPV	0.3750
	NPV	1
	LR+	6.800
Lee et al.(2019),TES/AR50%,LAT10%	SS	0.2500
	SP	0.9982
	PPV	0.5000
	NPV	0.9946
	LR+	139.250
Moiyadi et al.(2018), DCS/AR30-50%	SS	0
	SP	0.9545
	PPV	0
	NPV	0.8400
	LR+	0
Moiyadi et al.(2018), TES/AR50-80%	SS	0.5000
	SP	0.9459
	PPV	0.3333
	NPV	0.9722
	LR+	9.250
Motoyama et al.(2011),DCS & TES/AR50%	SS	1
	SP	1
	PPV	1
	NPV	1
	LR+	N/A
Nakagawa et al.(2020),TES/AR50%	SS	0.3000
	SP	1
	PPV	1
	NPV	0.9565
	LR+	N/A

Pastor et al.(2013),DCS,TES/AR50%,LAT10%	SS	N/A
	SP	1
	PPV	N/A
	NPV	1
	LR+	N/A
Piñeiro et al.(2015),TES/AR50%	SS	N/A
	SP	0.8750
	PPV	0
	NPV	1
	LR+	N/A
Plans et al.(2017),DCS/AR50%	SS	0
	SP	0.8977
	PPV	0
	NPV	0.9518
	LR+	0
Plans et al.(2017),DCS/TH5mA	SS	1
	SP	0.9091
	PPV	0.3333
	NPV	1
	LR+	11.000
Plans et al.(2017)/MT5mA	SS	0.6667
	SP	0.6854
	PPV	0.0667
	NPV	0.9839
	LR+	2.119
Plans et al.(2017)/MT5mA+AR50%	SS	0
	SP	0.9205
	PPV	0
	NPV	0.9529
	LR+	0
Plans et al.(2017)/MT5mA+TH5mA	SS	0.5000

	SP	1
	PPV	1
	NPV	0.9778
	LR+	N/A
Seidel et al.(2013),DCS/TH4mA	SS	0.1053
	SP	0.8765
	PPV	0.1667
	NPV	0.8068
	LR+	0.852
Seidel et al.(2013)/MT3mA	SS	0.2105
	SP	0.7342
	PPV	0.1600
	NPV	0.7945
	LR+	0.792
Seidel et al.(2013)/MT3mA+TH4mA	SS	0.0526
	SP	0.9494
	PPV	0.2000
	NPV	0.8065
	LR+	1.039
Seidel et al.(2020)/MT3mA	SS	0.3939
	SP	0.6980
	PPV	0.2241
	NPV	0.8387
	LR+	1.304
Song et al.(2015),TES/AR50%	SS	0.3333
	SP	1
	PPV	1
	NPV	0.8000
	LR+	N/A
Staarman et al.(2017),TES/AR50%	SS	0.3333
	SP	1

	PPV	1
	NPV	0.9848
	LR+	N/A
Szelényi et al.(2010),TES/AR50%,TH20mA,TH100V	SS	0.7500
	SP	0.5500
	PPV	0.4000
	NPV	0.8462
	LR+	1.666
Yue et al.(2014),TES/AR50%	SS	0
	SP	0.9762
	PPV	0
	NPV	0.9762
	LR+	0

Abbreviations for Supplementary Tables S3,S4,S5 and S6
AR: Amplitude criterion; **DCS:** Direct Cortical Stimulation; **i:**ipsilateral**; LAT:** Latency criterion; **LR+:**Positive Likelihood Ratio; **MEP:** Motor Evoked Potential **; MT:** Motor Threshold/Mapping criterion; **NaN:** Not available ; **NPV:** Negative Predictive Value; **PPV:** Positive Predictive Value **; PW:** Pulse Width; **SS:** Sensitivity**; SP**: Specificity ; **TES:** Transcranial Electrical Stimulation; **TH:** Threshold criterion

Supplementary Table S7: The table summarizes the relative rates of all motor deficits as well as the total number of early-transient, transient and permanent motor deficits in conjunction with MEP changes.

Authors	No of all new motor deficits/ Total no of patients(%)	No of early-transient motor deficits/ No of all MEP changes(%)	No of transient motor deficits/ No of all MEP changes(%)	No of permanent motor deficits/ No of all MEP changes(%)
TUMORS AND OTHER BRAIN LESIONS				
Giampiccolo et al.(2021)	**50%**	**12%**	**23%**	**38%**
	17%	**14%**	**21%**	**21%**
Gogos et al.(2020)	**10%**	**N/A**	**33%**	**17%**
Mammadk-hanli et al. (2020)	**N/A**	**N/A**	**N/A**	**N/A**
Abboud et al.(2019)	**35%**	**18%**	**18%**	**22%**
Majchrzak et al.(2018)	**51%**	**N/A**	**39%**	**61%**
Moiyadi et al.(2018)	**18%**	**0%**	**33%**	**0%**
Plans et al. (2017)	**20%**	**19%**	**0%**	**38%**
Zhou et al.(2017)	**14%**	**N/A**	**83%**	**17%**
Abboud et al.(2016)	**13%**	**N/A**	**62%**	**38%**
Boex et al.(2016)	**21%**	**31%**	**19%**	**50%**
Obermueller et al.(2015)	**27%**	**N/A**	**15%**	**13%**

Shiban et al.(2015)	**38%**	**N/A**	**67%**	**33%**
Lee et al. (2014)	**17%**	**N/A**	**0%**	**43%**
Gempt et al.(2013)	**33%**	**N/A**	**33%**	**48%**
Ostrý et al. (2013)	**32%**	**N/A**	**67%**	**0%**
Pastor et al.(2013)	**27%**	**N/A**	**33%**	**25%**
Seidel et al.(2013)	**30%**	**23%**	**20%**	**17%**
Sakurada et al.(2012)	**23%**	**N/A**	**25%**	**50%**
Senft et al.(2012)	**20%**	**N/A**	**57%**	**29%**
Hatiboglu et al.(2010)	**50%**	**N/A**	**N/A**	**N/A**
Ichikawa et al.(2010)	**14%**	**N/A**	**40%**	**20%**
*Szelényi et al.(2010)	**54%**	**30%**	**N/A**	**26%**
Kombos et al.(2009)	**13.3%**	**N/A**	**40%**	**0%**
Neuloh et al.(2009)	**27%**	**N/A**	**37%**	**14%**
Neuloh et al.(2007)	**31%**	**N/A**	**46%**	**20%**
Suess et al.(2006)	**15%**	**N/A**	**13%**	**36%**
*Neuloh et al.(2004)	**42%**	**N/A**	**39%**	**22%**
Kombos et al.(2001)	**11%**	**N/A**	**0%**	**17%**

Zhou et al. (2001)	**16%**	**N/A**	**N/A**	**N/A**
Cedzich et al.(1996)	**36%**	**N/A**	**27%**	**27%**
EPILEPSY SURGERY				
Koo et al. (2019)	**0.7%**	**N/A**	**0.7%**	**0%**
Neuloh et al.(2010)	**13%**	**N/A**	**19%**	**16%**
ANEURYSM CLIPPING				
Guo et al.(2021)	**11%**	**N/A**	**10%**	**25%**
Park et al.(2021)	**3%**	**N/A**	**25%**	**17%**
You et al.(2021)	**12%**	**N/A**	**N/A**	**N/A**
Kameda et al.(2020)	**5%**	**50%**	**0%**	**0%**
Byoun et al.(2019)	**3%**	**N/A**	**0%**	**40%**
Greve et al.(2019)	**7%**	**N/A**	**8%**	**15%**
Li et al. (2019)	**57%**	**3%**	**23%**	**30%**
Choi et al.(2017)	**2%**	**N/A**	**10%**	**20%**
Komatsu et al. (2017)	**0%**	**0%**	**0%**	**0%**
Staarman et al.(2017)	**2%**	**20%**	**N/A**	**N/A**
Kim et al.(2016)	**5%**	**N/A**	**N/A**	**N/A**

Maruta et al.(2016)	**7%**	**N/A**	**7%**	**10%**
Song et al.(2015)	**27%**	**50%**	**N/A**	**N/A**
Sasaki et al.(2014)	**3%**	**N/A**	**5%**	**9%**
Takebayashi et al. (2014)	**20%**	**N/A**	**32%**	**21%**
Yue et al.(2014)	**9%**	**7%**	**0%**	**13%**
*Dengler et al.(2013)	**6%**	**N/A**	**7%**	**7%**
Kang et al.(2013)	**8%**	**38%**	**N/A**	**N/A**
Maruta et al.(2012)	**14%**	**N/A**	**50%**	**0%**
Shi et al.(2012)	**N/A**	**N/A**	**0%**	**33%**
Motoyama et al. (2011)	**2%**	**20%**	**N/A**	**N/A**
Irie et al. (2010)	**7%**	**33%**	**N/A**	**N/A**
Yeon et al.(2010)	**1%**	**N/A**	**8%**	**0%**
*Szelényi et al.(2007)	**5%**	**N/A**	**14%**	**9%**
Weinzierl et al.(2007)	**0%**	**N/A**	**0%**	**0%**
Szelényi et al.(2006)	**13%**	**N/A**	**17%**	**50%**
Horiuchi et al.(2005)	**8%**	**N/A**	**30%**	**10%**
Suzuki et al. (2003)	**5%**	**N/A**	**20%**	**5%**

ENDOVASCULAR PROCEDURES FOR ANEURYSMS				
Nakagawa et al.(2020)	**6%**	**43%**	**N/A**	**N/A**
Wilent et al.(2020)	**2%**	**24%**	**N/A**	**N/A**
Lee et al.(2019)	**0.7%**	**14%**	**N/A**	**N/A**
Piñeiro et al.(2015)	**38%**	**N/A**	**0%**	**50%**
Hiraishi et al.(2011)	**14%**	**33%**	**N/A**	**N/A**

Supplementary Table S8: Causes of injury in tumor patients with permanent motor deficits

Authors		**Mechanical Injury**	**Vascular injury**	**Unclear nature of the injury**
Gogos et al.(2020)		-	2/58 (3.4%)[1)]	-
Seidel et al.(2020)		3/182 (1.6%)	3/182 (1.6%)	-
Plans et al. (2017)		-	1/92 (1.1%)	13/92(14.1%)
Boex et al.(2016)		-	5/104 (4.8%)	-
Obermueller et al.(2015)	Glioma	4/105 (3.8%)	1/105 (1%)	-
	Metastasis	1/53 (1.9%)	1/53 (1.9%)	-
Shiban et al.(2015)		-	1/14 (7.1%)	-
Lee et al. (2014)		-	3/84 (3.6%)[2)]	-
Gempt et al.(2013)		-	8/70 (11.4%)	2/70 (2.9%)
Seidel et al.(2013)		3/100(3%)	2/100(2%)	-
Sakurada et al.(2012)		-	1/30 (3.3%)	-
Hatiboglu et al.(2010)		-	1/16 (6.3%)	2/16 (12.5%)
Ichikawa et al.(2010)		-	1/21 (4.8%)	-
Neuloh et al.(2010)		3/86 (3.5%)	-	-
Szelényi et al.(2010)		15/25 (60%)	4/25 (16%)	-

Neuloh et al.(2009)	-	2/191(1%)	2/191(1%)
Neuloh et al.(2007)	-	7/88(8%)	-
Suess et al.(2006)	17/232 (7.3%)	2/232 (0.9%)	-

Notes:

1)The authors also report about previous series with almost equal distribution of vascular and mechanical injuries (in this previous series they applied Penfield stimulation without MEP monitoring and without monopolar short train mapping)
2) The authors stated they could only speculate on the cause

In the remaining 14 included tumor papers no specification about the type of injury that led to permanent motor deficit was described