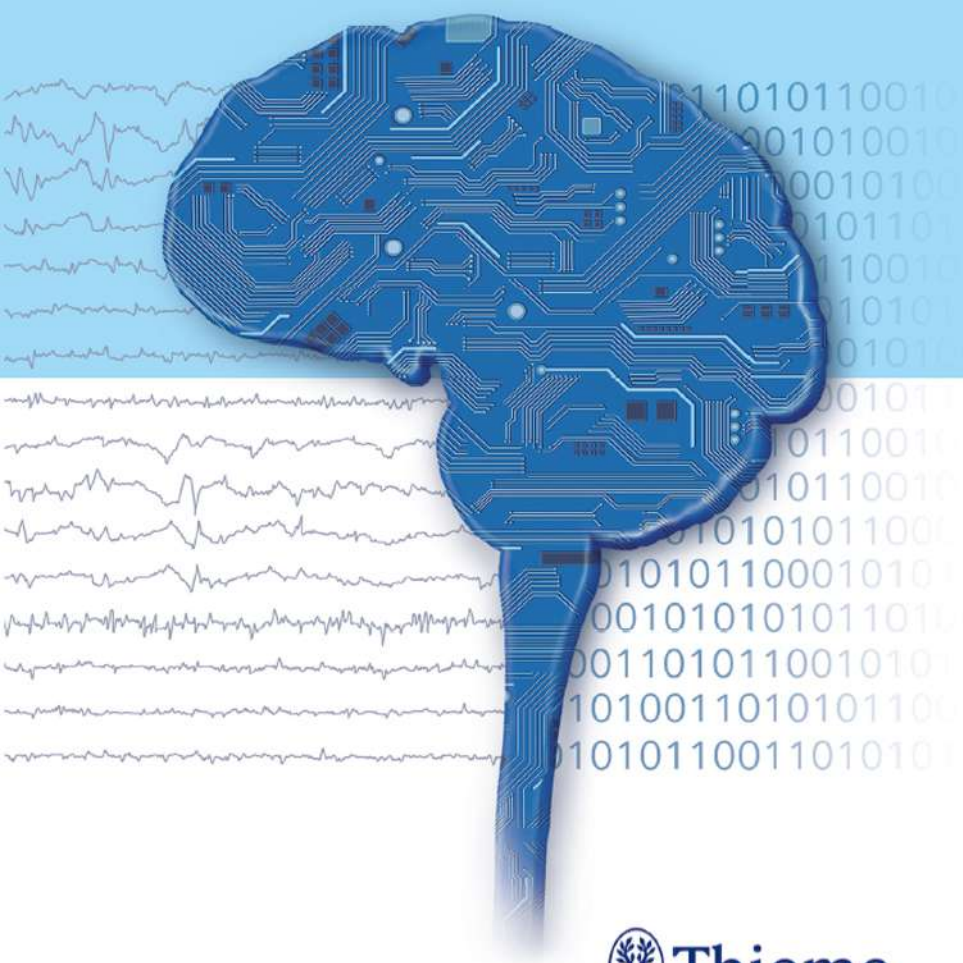
Handbook of Neurosurgery

Ninth Edition

Mark S. Greenberg



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Handbook of Neurosurgery

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Dedication

I am dedicating this ninth edition to my family. To my wife, Debbie, who tolerated my absences without complaint while I worked on the book and who brought me meals at the hospital so that I could write without distractions. And to my children, Alexa, Leah, Michael and Shaina, wishing them great success and happiness.

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Preface

During the preparation of this, the 9th edition of the *Handbook of Neurosurgery*, it dawned on me that the origins and the perpetuation of this book are probably antithetical to that of the majority of medical books. Instead of creating a book in an effort to help take care of patients, this book arose as a result of taking care of patients. It began as a collection of notes that I kept as my needs emerged while practicing neurosurgery. I added to it during my residency as we presented weekly grand rounds on patients that we were treating in the OR, the wards, and the ICU. Later, in my practice, when I encountered something that I had to look up, I included the results of that research in the book for future reference. The book grew organically, instead of arising from a preplanned blueprint. I feel that this has probably been part of the book's success, as well as a source of some of the unevenness of coverage, for which I gradually make amends. While it may not have occurred to me that this was likely a different genesis than most books, I have always said that my patients appear on all the pages of this book. And it is to them that I am eternally grateful.

Acknowledgments

I would like to take this opportunity to acknowledge the fantastic folks at Thieme Medical Publishers. Their support and willingness to take my opinions seriously has made it a pleasure to bring out this new edition. In particular, I would like to recognize my efficient and thorough (words that do not often coexist when describing an individual) senior editor, Naamah Schwartz. Many thanks, again, to my executive editor, Timothy Hiscock, and to Thieme's amazing wizard of XML, Dr. Michael Wachinger, Director of Content Management.

On the Neurosurgical side, I thank those who put up with me during my training (with special fondness for my chairman, Dr. John M. Tew, Jr.), and those who I am now happy to count among my friends and colleagues, especially my chairman and most trusted source for advice, Dr. Harry van Loveren.

Abbreviations and Symbols

Abbreviations used only locally are defined in that section using boldface type. Numbers following entries below indicate the page number for the relevant section.

Abbreviations	
a.	artery (aa. = arteries)
AA	anaplastic astrocytoma (p. 626)
ABC	aneurysmal bone cyst (p. 813)
Abx.	antibiotics
AC	arachnoid cyst (p. 262)
ACA	anterior cerebral artery
ACAS	asymptomatic carotid artery stenosis (p. 1342) *or* Asymptomatic Carotid Atherosclerosis Study (p. 1343)
ACDF	anterior cervical discectomy & fusion (p. 1118)
ACE	angiotensin-converting enzyme
ACh	acetylcholine (neurotransmitter)
AChA	anterior choroidal artery
ACoA	anterior communicating artery
ACTH	adrenocorticotropic hormone (corticotropin) (p. 165)
AD	autosomal dominant
ADH	antidiuretic hormone (p. 165)
ADI	atlantodental interval (p. 229)
ADPKD	autosomal dominant polycystic kidney disease (p. 1253)
ADQ	abductor digiti quinti (or minimi)
AED	anti-epileptic drug (anticonvulsant) (p. 462)
AFO	ankle-foot-orthosis (p. 540)
AFP	alpha-fetoprotein (p. 605)
Ag	antigen
AHA	American Heart Association
AHCPR	Agency for Health Care Policy and Research (of the U. S. Public Health Service)
AICA	anterior inferior cerebellar artery (p. 90)
AIDP	acute inflammatory demyelinating polyradiculoneuropathy (p. 199)
AIDS	acquired immunodeficiency syndrome (p. 346)
AIN	anterior interosseous neuropathy (p. 520)
AIS	acute ischemic stroke (p. 1330)
AKA	also known as
ALIF	anterior lumbar interbody fusion (p. 1583)
ALARA	As Low As Reasonably Achievable (p. 241)
A-line	arterial line
ALL	anterior longitudinal ligament
ALS	amyotrophic lateral sclerosis (p. 1133)
AMS	acute mountain sickness (p. 884)
AN	acoustic neuroma (p. 683)
ANA	antinuclear antibodies
AOD	atlantooccipital dislocation (p. 1000)
AOI	atlantooccipital interval (p. 1001)
AP	antero-posterior
APAG	antipseudomonal aminoglycoside
APAP	acetaminophen (p. 152)
APD	afferent pupillary defect (p. 567)

APTT	(or PTT) activated partial thromboplastin time
ARDS	adult respiratory distress syndrome
ASA	American Society of Anesthesiologists *or* aspirin (acetylsalicylic acid)
ASAP	as soon as possible
ASD	antisiphon device
AT	anterior tibialis (tibialis anterior)
AT/RT	atypical teratoid/rhabdoid tumor (p. 681)
ASHD	atherosclerotic heart disease
AVM	arteriovenous malformation (p. 1300)
AVP	arginine vasopressin (p. 165)
β-hCG	beta-human chorionic gonadotropin (p. 605)
BA	basilar artery
BBB	blood-brain barrier (p. 98)
BC	basal cisterns (p. 959)
BCP	birth control pills (oral contraceptives)
BCVI	blunt cerebrovascular injury (p. 885)
BG	basal ganglia
BI	basilar impression/invagination (p. 233)
BMD	bone mineral density (p. 1049)
BMP	bone morphogenic protein (p. 1512)
BOB	benign osteoblastoma (p. 823)
BP	blood pressure
BR	bed rest (activity restriction)
BSF	basal skull fracture (p. 919)
BSG	brainstem glioma (p. 649)
Ca	cancer
CA	cavernous malformation (p. 1310)
CAA	cerebral amyloid angiopathy (p. 1406)
CABG	coronary artery bypass graft
CAD	coronary artery disease
CAT	(or CT) computerized (axial) tomography
CBF	cerebral blood flow (p. 1330)
CBV	cerebral blood volume
CBZ	carbamazepine (p. 467)
CCB	calcium-channel blocker
CCF	carotid-cavernous (sinus) fistula (p. 1321)
CCHD	congenital cyanotic heart disease
CCI	condyle-C1 interval (p. 1001) (atlantooccipital interval)
CD	Cushing's disease (p. 744)
CEA	carotid endarterectomy (p. 1359) *or* carcinoembryonic antigen (p. 606)
CECT	contrast enhanced CT
cf	(Latin: confer) compare
cGy	centi-Gray (1cGy = 1 rad)
CHF	congestive heart failure
CI	confidence interval (statistics)
CIDP	chronic inflammatory demyelinating polyradiculoneuropathy (p. 201)
CIP	critical illness polyneuropathy (p. 545)
CJD	Creutzfeldt-Jakob disease (p. 381)
CM	cavernous malformation (p. 1310)
CMAP	compound motor action potential (EMG)
$CMRO_2$	cerebral metabolic rate of oxygen consumption (p. 1331)

CMT	Charcot-Marie-Tooth (p. 544)
CMV	cytomegalovirus
CNL	chemonucleolysis
CNS	central nervous system
cCO	continuous cardiac output
CO	cardiac output *or* carbon monoxide (p. 223)
CPA	cerebellopontine angle
CPM	central pontine myelinolysis (p. 127)
CPN	common peroneal nerve (p. 538)
CPP	cerebral perfusion pressure (p. 891)
Cr. N.	cranial nerve(s)
CRH	corticotropin-releasing hormone (p. 165)
CRP	C-reactive protein
CRPS	complex regional pain syndrome (p. 501)
CSF	cerebrospinal fluid (p. 396)
CSM	cervical spondylotic myelopathy (p. 1130)
CSO	craniosynostosis (p. 265)
CSW	cerebral salt wasting (p. 130)
CTA	CT angiogram (p. 243)
CTP	CT perfusion (p. 244)
CTS	carpal tunnel syndrome (p. 522)
CTV	CT venogram
CVP	central venous pressure
CVR	cerebrovascular resistance (p. 1330)
CVS	cerebral vasospasm (p. 1237)
CVT	cerebral venous thrombosis (p. 1377)
CXR	chest X-ray
DACA	distal anterior cerebral artery (p. 1271)
DAI	diffuse axonal injury (p. 884)
DBM	demineralized bone matrix (p. 1512)
DC	decompressive craniectomy
D/C	discontinue
DCI	delayed cerebral ischemia (p. 1230)
DDAVP	1-deamino-8-D-arginine vasopressin (desmopressin) (p. 137)
DDx	differential diagnosis (p. 1475)
DBS	deep brain stimulation (p. 1624)
DI	diabetes insipidus (p. 132)
DIND	delayed ischemic neurologic deficit (p. 1238)
DIG	desmoplastic infantile astrocytoma and ganglioglioma (p. 661)
DISH	diffuse idiopathic skeletal hyperostosis (p. 1181)
DKA	diabetic keto-acidosis
DLC	disco-ligamentous complex (p. 1026)
DLIF	direct lateral lumbar interbody fusion (p. 1589)
DOC	drug of choice
DM	diabetes mellitus
DMZ	dexamethasone
DNT	(or DNET) dysembryoplastic neuroepithelial tumors (p. 661)
DOE	dyspnea on exertion
DOMS	delayed onset muscle soreness (p. 1149)
DPL	diagnostic peritoneal lavage
DREZ	dorsal root entry zone lesion (p. 1670)

DSA	digital subtraction angiogram
DSD	degenerative spine disease (p. 1142)
DST	dural sinus thrombosis (p. 1377)
DTN	"door to needle"
DTs	delirium tremens (p. 221)
DTT	diffusion tensor tractography MRI (p. 249)
DVT	deep-vein thrombosis (p. 183)
DWI	(or DWMRI) diffusion-weighted imaging (MRI) (p. 247)
EAC	external auditory canal
EAM	external auditory meatus
EAST	Eastern Association for the Surgery of Trauma
EBRT	external beam radiation therapy
EBV	Epstein-Barr Virus
ECM	erythema chronicum migrans (p. 350)
EDC	electrolytically detachable coils
EDH	epidural hematoma (p. 927)
EHL	extensor hallucis longus
ELISA	enzyme-linked immunosorbent assay
ELST	endolymphatic sac tumors (p. 720)
EM	electron microscope (microscopy)
ENG	electronystagmography (p. 687)
ENT	ear, nose and throat (otolaryngology)
EOM	extra-ocular muscles (p. 571)
EOO	external oculomotor ophthalmoplegia
E/R	emergency room or department
ESR	erythrocyte sedimentation rate
EST	endodermal sinus tumor (p. 731)
EtOH	ethyl alcohol (ethanol)
ET tube	endotracheal tube
ETV	endoscopic third ventriculostomy (p. 432)
EVD	external ventricular drain (ventriculostomy)
EVT	endovascular therapy (p. 1694)
FCU	flexor carpi ulnaris
FDP	flexor digitorum profundus
FIM	Functional Independence Measure (p. 1439)
FLAIR	fluid-attenuated inversion recovery (on MRI) (p. 245)
FM	face mask
FMD	fibromuscular dysplasia (p. 216)
FSH	follicle stimulating hormone (p. 165)
F/U	follow-up
FUO	fever of unknown origin
GABA	gamma-aminobutyric acid
GBM	glioblastoma (multiforme) (p. 626)
GBS	Guillain-Barré syndrome (p. 199)
GCA	giant cell arteritis (p. 210)
GCS	Glasgow coma scale (p. 312)
GCT	granular cell tumor (p. 733) *or* germ cell tumor (p. 730)
GD	Graves' disease
GFAP	glial fibrillary acidic protein (p. 603)
GGT	gamma glutamyl transpeptidase
GH	growth hormone (p. 165)

GH-RH	growth hormone releasing hormone (p. 165)
GMH	germinal matrix hemorrhage (p. 1421)
GNR	gram-negative rods
GnRH	gonadotropin-releasing hormone (p. 165)
GSW	gunshot wound
GTC	generalized tonic-clonic (seizure)
GTR	gross total resection
H/A	headache (p. 189)
H&H	Hunt and Hess (SAH grade) (p. 1223)
H&P	history and physical exam
HBsAg	hepatitis B surface antigen
HCD	herniated cervical disc (p. 1115)
hCG	human chorionic gonadotropin (p. 605)
HCP	hydrocephalus (p. 408)
HDT	hyperdynamic therapy (p. 1244)
HGB	hemangioblastoma (p. 716)
Hgb-A1C	hemoglobin A1C
hGH	human growth hormone
HH	hypothalamic hamartomas (p. 277) *or* homonymous hemianopsia
HHT	hereditary hemorrhagic telangiectasia (p. 1309)
HIV	human immunodeficiency virus
HLD	herniated lumbar disc (p. 1087)
HLA	human leukocyte antigen
H.O.	house officer
HNP	herniated nucleus pulposus (herniated disc) (p. 1087)
HNPP	hereditary neuropathy with liability to pressure palsies (p. 544)
HOB	head of bed
HPA	hypothalamic-pituitary-adrenal axis
HPF	high power field (used in histology, corresponds to 0.23 mm^2)
HRQOL	health related quality of life
HSE	herpes simplex encephalitis (p. 379)
HTN	hypertension
IAC	internal auditory canal
IASDH	infantile acute subdural hematoma (p. 933)
ICA	internal carotid artery
ICG	indocyanine green
ICH	intracerebral hemorrhage (p. 1402)
IC-HTN	intracranial hypertension (increased ICP)
ICP	intracranial pressure (p. 891)
ICU	intensive care unit
IDDM	insulin-dependent diabetes mellitus
IDET	intradiscal endothermal therapy (p. 1093)
IDH	isocitrate dehydrogenase (p. 621)
IEP	immune electrophoresis
IG	image guidance (intraoperative)
IGF-1	insulin-like growth factor-1 (AKA somatomedin-C) (p. 165)
IIH	idiopathic intracranial hypertension (pseudotumor cerebri) (p. 794)
IIHWOP	idiopathic intracranial hypertension without papilledema (p. 796)
IJV	internal jugular vein
IMRT	intensity modulated radiation therapy
INO	internuclear ophthalmoplegia (p. 571)

iNPH	(idiopathic) normal pressure hydrocephalus (p. 417)
INR	international normalized ratio (p. 179)
IPS	inferior petrosal sinus
IPA	idiopathic paralysis agitans (Parkinson's disease) (p. 191)
ISAT	International Subarachnoid Hemorrhage Aneurysm Trial (p. 1255)
IT	intrathecal
ITB	intrathecal baclofen (p. 1632)
IVC	intraventricular catheter *or* inferior vena cava
IVH	intraventricular hemorrhage (p. 1464)
IVP	intravenous push (medication route) *or* intravenous pyelogram (X-ray study)
JPS	joint position sense
LBP	low back pain (p. 1065)
LDD	Lhermitte-Duclos disease (p. 663)
LE	lower extremity
LFTs	liver function tests
LGG	low-grade glioma
LH	luteinizing hormone (p. 165)
LH-RH	luteinizing hormone releasing hormone (p. 165)
LMD	low molecular weight dextran
LMN	lower motor neuron (p. 506)
LMW	low-molecular-weight (e.g. heparins)
LOC	loss of consciousness
LOH	loss of heterozygosity
LP	lumbar puncture (p. 1598)
LSO	lumbo-sacral orthosis
MAC	mycobacterium avian complex (p. 370)
MAOI	monoamine oxidase inhibitor
MAP	mean arterial pressure
MAST®	military anti-shock trousers
MB	medulloblastoma (p. 676)
MBEN	medulloblastoma with extensive nodularity (p. 677)
MBI	modified Barthel index (▶ Table 85.6)
MCA	middle cerebral artery
mcg	(or μg) microgram
MCP	mean carotid pressure *or* metacarpal phalangeal
MDCTA	multidetector CT angiography
MDB	medulloblastoma (p. 676)
MDMA	methylenedioxymethamphetamine (p. 192)
mg	milligram
MGMT	O^6-methylguanine-DNA methyltransferase (p. 628)
MGUS	monoclonal gammopathy of undetermined significance (p. 551)
MI	myocardial infarction
MIB-1	monoclonal anti-Ki-67 antibody (p. 604)
MIC	minimum inhibitory concentration (for antibiotics)
MID	multi-infarct dementia
MISS	minimally invasive spine surgery
mJOA	modified Japanese Orthopedic Association scale (p. 1132)
MLF	medial longitudinal fasciculus
MLS	midline shift (p. 960)
MM	myelomeningocele (p. 281) *or* multiple myeloma (p. 849)
MMD	moyamoya disease (p. 1384)

MMN	multifocal motor neuropathy (p. 1491)
MMPI	Minnesota Multiphasic Personality Inventory
mos	months
MPTP	1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (p. 192)
MRA	MRI angiogram (p. 247)
mRS	modified Rankin Scale (▶ Table 85.5)
MRS	MRI spectroscopy (p. 248)
MRSA	methicillin resistant *staphylococcus aureus*
MS	microsurgery *or* multiple sclerosis (p. 194)
MSO_4	morphine sulfate
MTP	metatarsal phalangeal
MTT	mean transit time (on CT perfusion) (p. 244)
MUAP	motor unit action potential (p. 258)
MVA	motor vehicle accident
MVD	microvascular decompression (p. 1647)
MW	molecular weight
n.	nerve (nn. = nerves)
Na	(or Na^+) sodium
N_2O	nitrous oxide (p. 117)
NAA	N-acetyl aspartate (p. 248)
NAP	nerve action potential (p. 511)
NASCET	North American Symptomatic Carotid Endarterectomy Trial (p. 1359)
NB	(Latin: *nota bene*) note well
NC	nasal cannula
NCCN	National Comprehensive Cancer Network
NCD	neurocutaneous disorders (p. 608)
NCV	nerve conduction velocity
NEC	neurenteric cyst (p. 307) *or* necrotizing enterocolitis
NEXUS	National Emergency X-Radiography Utilization Study (p. 991)
NF	(or NFT) neurofibromatosis (p. 608)
NF1	neurofibromatosis type 1 (p. 609)
NF2	neurofibromatosis type 2 (p. 610)
NG tube	nasogastric tube
NGGCT	non-germinomatous germ cell tumors (p. 731)
NFPA	nonfunctioning pituitary adenoma
NIHSS	NIH (National Institute of Health) Stroke Scale (p. 1348)
NMBA	neuromuscular blocking agent (p. 149)
NMO	neuromyelitis optica (Devic disease) (p. 1489)
NOS	not otherwise specified
NPH	normal pressure hydrocephalus (p. 417)
NPS	neuropathic pain syndrome (p. 494)
NS	normal saline
NSAID	non-steroidal anti-inflammatory drug (p. 152)
NSCLC	non-small-cell cancer of the lung (p. 834)
NSF	nephrogenic systemic fibrosis (p. 247)
NSM	neurogenic stunned myocardium (p. 1236)
N/V	nausea and vomiting
NVB	neurovascular bundle
OAD	occipital atlantal dislocation, see atlantooccipital dislocation (p. 1000)
OALL	ossification of the anterior longitudinal ligament (p. 1181)
OC	occipital condyle

OCB	oligoclonal bands (in CSF) (p. 197)
OCF	occipital condyle fracture (p. 920)
ODG	oligodendroglioma (p. 631)
OEF	oxygen extraction fraction
OFC	occipital-frontal (head) circumference
OGST	oral glucose suppression test (for growth hormone) (p. 757)
OMO	open-mouth odontoid (C-spine X-ray view)
OMP	oculomotor (third nerve) palsy
ONSF	optic nerve sheath fenestration (p. 800)
OP	opening pressure (on LP) (p. 1599)
OPLL	ossification of the posterior longitudinal ligament (p. 1179)
OR	operating room
ORIF	open reduction/internal fixation
OS	overall survival
OTC	over the counter (i.e., without prescription)
PACU	post-anesthesia care unit (AKA recovery room, PAR)
PADI	posterior atlantodental interval (p. 229)
PAN	poly- (or peri-) arteritis nodosa (p. 215)
PBPP	perinatal brachial plexus palsy (p. 555)
$PbtO_2$	brain tissue oxygen tension (p. 900)
PC	pineal cyst (p. 790)
PCA	pilocytic astrocytoma (p. 644) *or* posterior cerebral artery
PCB	pneumatic compression boot
PCC	prothrombin complex concentrate (p. 181)
PCI	prophylactic cranial irradiation
PCN	penicillin
PCNSL	primary CNS lymphoma (p. 725)
P-comm	posterior communicating artery
PCV	procarbazine, CCNU, & vincristine (chemotherapy)
PCR	polymerase chain reaction
PCWP	pulmonary capillary wedge pressure
PDA	patent ductus arteriosus
PDN	painful diabetic neuropathy (p. 494)
PDR	Physicians Desk Reference®
peds	pediatrics (infants & children)
PEEK	poly-ether-ether-ketone (graft material)
PET	positron emission tomography (scan)
p-fossa	posterior fossa
PFS	progression-free survival
PFT	pulmonary function test
PHN	postherpetic neuralgia (p. 498)
PHT	phenytoin (Dilantin®) (p. 464)
PICA	posterior inferior cerebellar artery (p. 89)
PIF	prolactin release inhibitory factor (p. 165)
PIN	posterior interosseous neuropathy (p. 535)
PION	posterior ischemic optic neuropathy (p. 1097)
PIVH	periventricular-intraventricular hemorrhage (p. 1421)
PLAP	placental alkaline phosphatase (p. 731)
PLEDs	periodic lateralizing epileptiform discharges
PLIF	posterior lumbar interbody fusion
PM	pars marginalis (p. 65)

PMA	progressive muscular atrophy (p. 198) *or* pilomyxoid astrocytoma (p. 651)
PMH	pure motor hemiparesis
PML	progressive multifocal leukoencephalopathy (p. 346)
PMMA	polymethylmethacrylate (methylmethacrylate)
PMR	polymyalgia rheumatica (p. 213)
PMV	pontomesencephalic vein
POD	postoperative day
PPV	positive predictive value: in unselected patients who test positive, PPV is the probability that the patient has the disease
PR	per rectum
PRES	posterior reversible encephalopathy syndrome (p. 209)
PRF	prolactin releasing factor (p. 165)
PIF	prolactin (releasing) inhibitory factor (p. 165)
PRN	as needed
PRSP	penicillinase resistant synthetic penicillin
PSNP	progressive supra-nuclear palsy (p. 193)
PSR	percutaneous stereotactic rhizotomy (for trigeminal neuralgia) (p. 1642)
PSW	positive sharp waves (on EMG) (p. 258)
pt	patient
PT	physical therapy *or* prothrombin time
PTC	pituicytoma (p. 734), pseudotumor cerebri (p. 794)
PTR	percutaneous trigeminal rhizotomy
PTT	(or APTT) partial thromboplastin time
PUD	peptic ulcer disease
PVP	percutaneous vertebroplasty (p. 1052)
PWI	perfusion-weighted imaging (MRI) (p. 248)
PXA	pleomorphic xanthoastrocytoma (p. 652)
q	(Latin: *quaque*) every (medication dosing)
RA	rheumatoid arthritis
RAPD	relative afferent pupillary defect (p. 567)
RASS	Richmond agitation-sedation scale (p. 147)
RCVS	reversible cerebral vasoconstrictive syndrome (p. 1218)
rem	roentgen-equivalent man
REZ	root entry zone
RFR	radiofrequency rhizotomy (p. 1642)
rFVIIa	recombinant (activated) factor VII
RH	recurrent artery of Heubner
rhBMP	recombinant human bone morphogenetic protein (p. 1512)
R/O	rule out
ROM	range of motion
ROP	retro-odontoid pseudotumor (p. 1470)
RPA	recursive partitioning analysis
RPDB	randomized prospective double-blind
RPLS	reversible posterior leukoencephalopathy syndrome; see posterior reversible encephalopathy syndrome (p. 209)
RPNB	randomized prospective non-blinded
RTOG	Radiation Therapy Oncology Group
RTP	return to play (sports)
rt-PA or tPA	recombinant tissue-type plasminogen activator (AKA tissue plasminogen activator) e.g. alteplase
RTX	(or XRT) radiation therapy (p. 1680)

S/S	signs and symptoms
S2AI screws	S2-alar-iliac screws (p. 1595)
SAH	subarachnoid hemorrhage (p. 1251) OR Selective amygdalo-hippocampectomy (p. 1676)
SBE	subacute bacterial endocarditis
SBO	spina bifida occulta (p. 280)
SBP	systolic blood pressure
SCA	superior cerebellar artery
SCLC	small-cell lung cancer (p. 833)
SCD	sequential compression device
SCI	spinal cord injury (p. 980)
SCM	sternocleidomastoid (muscle)
SD	standard deviation
SDE	subdural empyema (p. 343)
SDH	subdural hematoma (p. 930)
SE	status epilepticus (for seizures) (p. 486)
SEA	spinal epidural abscess (p. 365)
SEGA	subependymal giant cell astrocytoma (p. 612)
SEP	(or SSEP) somatosensory evoked potential
SG	specific gravity
SHH	sonic hedgehog
SIAD	syndrome of inappropriate antidiuresis (p. 125)
SIADH	syndrome of inappropriate antidiuretic hormone (ADH) secretion (p. 126)
SIDS	sudden infant death syndrome
SIH	spontaneous intracranial hypotension (p. 403)
sICH	spontaneous intracerebral hemorrhage (p. 1402)
SIRS	septic inflammatory response syndrome
$SjVO_2$	jugular venous oxygen saturation (p. 900)
SLE	systemic lupus erythematosus
SLIC	subaxial injury classification (p. 1026)
SMC	spinal meningeal cyst (p. 1202)
SMT	spinal manipulation therapy (p. 1076)
SNAP	sensory nerve action potential (EMG) (p. 259)
SNUC	sinonasal undifferentiated carcinoma (p. 1466)
SOMI	sternal-occipital-mandibular immobilizer (p. 974)
SON	supraorbital neuralgia (p. 497)
S/P	status-post
SPAM	subacute progressive ascending myelopathy (p. 1059)
SPECT	single positron emission computed tomography (scan)
SPEP	serum protein electrophoresis
SQ	subcutaneous injection
SRS	stereotactic radiosurgery (p. 1684)
SRT	stereotactic radiotherapy (p. 1684)
SSEP	(or SEP) somatosensory evoked potential
SSPE	subacute sclerosing panencephalitis (p. 253)
SSRI	selective serotonin reuptake inhibitors
SSS	superior sagittal sinus
STA	superficial temporal artery
STAT	immediately (abbreviation of Latin *statim*)
STICH	Surgical Trial in Intracerebral Haemorrhage (p. 1418)
STIR	short tau inversion recovery (MRI image)
STN	subthalamic nucleus

STSG	Spine Trauma Study Group
SUNCT	short-lasting unilateral neuralgiform H/A with conjunctival injection and tearing (p. 496)
SVC	superior vena cava
SVM	spinal vascular malformations (p. 1200)
SVR	systemic venous resistance
SVT	supraventricular tachycardia
SWS	Sturge–Weber syndrome (p. 614)
Sz.	seizure (p. 458)
T1WI	T1 weighted image (on MRI) (p. 244)
T2WI	T2 weighted image (on MRI) (p. 245)
TAL	transverse atlantal ligament (p. 75)
TBA	total bilateral adrenalectomy (p. 765)
TBI	traumatic brain injury
TCA	tricyclic antidepressants
TCD	transcranial Doppler (p. 1241)
TDL	tumefactive demyelinating lesions (p. 197)
TE	time to echo (on MRI) (p. 244)
TEE	transesophageal echocardiogram
TEN	toxic epidermal necrolysis
TENS	transcutaneous electrical nerve stimulation
TGN	trigeminal neuralgia (p. 1638)
T-H lines	Taylor-Haughton lines (p. 69)
TIA	transient ischemic attack (p. 1330)
TICH	traumatic intracerebral hemorrhage (hemorrhagic contusion) (p. 926)
TIVA	total intravenous anesthesia
TLIF	transforaminal lumbar interbody fusion (p. 1589)
TLISS	thoracolumbar injury severity score (p. 1047)
TLJ	thoracolumbar junction
TLSO	thoracolumbar-sacral orthosis
TM	tympanic membrane
TP53	tumor protein 53
t-PA or tPA	tissue plasminogen activator
TR	time to repetition (on MRI) (p. 244)
TRH	thyrotropin releasing hormone; AKA TSH-RH (p. 165)
TS	transverse sinus
TSC	tuberous sclerosis complex (p. 612)
TSH	thyroid-stimulating hormone (thyrotropin) (p. 165)
TSV	thalamostriate vein
TTP	thrombotic thrombocytopenic purpura
TVO	transient visual obscurations (p. 796)
Tx.	treatment
UBOs	unidentified bright objects (on MRI)
UE	upper extremity
UMN	upper motor neuron (p. 506)
UTI	urinary tract infection
URI	upper respiratory tract infection
U/S	ultrasound
VA	vertebral artery *or* ventriculoatrial
VB	vertebral body
VBI	vertebrobasilar insufficiency (p. 1374)
VEMP	vestibular evoked myogenic potential (p. 688)

VHL	von Hippel-Lindau (disease) (p. 718)
VKA	vitamin K antagonist (e.g. warfarin)
VMA	vanillylmandelic acid
VP	ventriculoperitoneal
VS	vestibular schwannoma (p. 683)
VTE	venous thromboembolism
VZV	(herpes) varicella zoster virus
WBC	white blood cell (count)
WBXRT	whole brain radiation therapy (p. 841)
WFNS	World Federation of Neurosurgical Societies (grading SAH) (p. 1223)
WHO	World Health Organization
wks	weeks
WNL	within normal limits
WNT	wingless/integrated (signal transduction pathway)
w/o	without
WRS	word recognition score (p. 686)
W/U	work-up (evaluation)
XLIF	extreme lateral lumbar interbody fusion (p. 1589)
XRT	(or RTX) radiation therapy (p. 1680)
Symbols	
℞	prescribing information
→	causes or leads to
Δ	change
✓	check (e.g. lab or exam item to check)
↑	increased
↓	decreased
≈	approximately
↳	innervates (nerve distribution)
⇒	vascular supply
↳	a branch of the preceding nerve
★	crucial point
✖	caution; possible danger; negative factor...
Σ	summary
∴	therefore
Instrumentation: the following shorthand allows rapid identification of metrics for spinal instrumentation:	
ENTRY	screw entry site
TRAJ	screw trajectory
TARGET	object to aim for
SCREWS	typical screw specifications

Conventions

► **Box types.** The *Handbook of Neurosurgery* uses the following seven box types:

Drug info

Drug description & dosage.

Key concepts

Foundational knowledge in brief.

Practice guideline

Evidence-based guidelines. See below (in this section) for definitions. For a listing of evidence-based guidelines contained in this book, see the index under "Practice guideline."

Booking the case

These sections appear under certain specific operations to help when scheduling that surgery. Default information appears below (in this section); for example, a specific type of anesthesia will only be mentioned if something other than general anesthesia is typically used. A list of operations addressed by this means can be found in the index under "Booking the case."

Σ

Summarizing or synthesizing information from the associated text.

Side information

E.g., Greenberg IMHO.

Signs / symptoms

A description of signs and symptoms.

► **Cross references.** Cross references: the terms "see below" and "see above" are normally used when the referenced item is on the same page, or at most on the following (or preceding) page. When further excursions are needed, the page number will usually be included.

► **Default values.** These details are not repeated in each section or "Booking the case" box.

1. position: (depends on the operation)
2. pre-op:
   a) NPO after midnight the night before except meds with sips of water
   b) antithrombotics: discontinue Coumadin® ≥ 3 days prior to surgery, Plavix® 5–7 d pre-op, aspirin 7–10 d pre-op, other NSAIDs 5 d pre-op

3. cardiology/medical clearance as needed
4. anesthesia: default = general anesthesia, unless otherwise specified
5. equipment: special devices such as ultrasonic aspirator, image guidance…
6. instrumentation: standard surgical instrument trays for a specific operation are assumed. Special instrumentation resident in the hospital will be listed
7. implants: this usually requires scheduling with a vendor (manufacturers representative/distributor) to provide
8. neuromonitoring will be listed if typically used
9. post-op: default care is on the ward (ICU is typically needed after craniotomy)
10. blood availability: specified if recommended
11. consent (these items use lay terms for the patient—not all-inclusive):
    ★ **Disclaimers**: *informed consent* for surgery requires disclosure of risks and benefits that would substantively affect a normal person's decision to have the operation. It cannot and should not attempt to include every possibility. The items listed in this section are included as memory joggers for some items for various procedures, but are not meant to be all inclusive. The omission of information from this memory aid is not to be construed as implying that the omitted item is not important or should not be mentioned.
    a) procedure: the typical operation and some possible common contingencies
    b) alternatives: non-surgical (AKA "conservative") treatment is almost always an option
    c) complications:
        - risks of general anesthesia include: heart attack, stroke, pneumonia
        - infection: a risk with any invasive procedure
        - usual **craniotomy** complications include: bleeding intra-op and postop, seizure, stroke, coma, death, hydrocephalus, meningitis, and neurologic deficit related to the area of surgery including (for applicable locations): paralysis, language or sensory disturbances, coordination impairment…
        - usual **spine surgery** complications include: injury to nerve or spinal cord with possible numbness, weakness or paralysis, failure of the operation to achieve the desired result, dural opening which may cause a CSF leak, which occasionally needs surgical repair. Hardware complications (when used) include: breakage, pull-out, malposition. Although a rare complication, it is serious enough that it bears mentioning in cases positioned prone with possible significant blood loss (> 2 L): blindness (due to PION (p. 1097))

► **Evidence-Based Medicine: Definitions.** These definitions are referred to in the "Practice guideline" boxes.

Strength of recommendation		Description
Level I, II, III[a]	Level A, B, C, D[b]	
Level I High degree of clinical certainty	**Level A**	Based on consistent Class I evidence (well-designed, prospective randomized controlled studies)
	Level B	Single Class I study or consistent Class II evidence or strong Class II evidence especially when circumstances preclude randomized clinical trials
Level II Moderate degree of clinical certainty	**Level C**	Usually derived from Class II evidence (one or more well-designed comparative clinical studies or less well-designed randomized studies) or a preponderance of Class III evidence
Level III Unclear clinical certainty	**Level D**	Generally based on Class III evidence (case series, historical controls, case reports and expert opinion). Useful for educational purposes and to guide future research

[a] as used in the Guidelines for the Management of Severe Traumatic Brain Injury, 3rd edition (Brain Trauma Foundation: Introduction. J Neurotrauma 24, Suppl 1: S1–2, 2007).
[b] as used in the Guidelines for the Surgical Management of Cervical Degenerative Disease (Matz P G, et al. Introduction and methodology. J Neurosurg: Spine 11 (2): 101–3, 2009).

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Part I

Anatomy and Physiology

I