Cambridge University Press 978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

Note: page numbers in *italics* refer to figures and tables

advanced combat helmet (ACH) 38-39 age-at-injury, animal models 127–128 age-dependent outcomes of TBI animal models 127-128 children 126-127 lateral fluid percussion injury rodent model 117 ageing population see elderly people airbags, road traffic injury prevention 7 alcohol consumption/intoxication neurotrauma in low- and middle-income countries 24 - 25road traffic injuries 6, 7 severe TBI 105 amantadine hydrochloride 126 American Spinal Injury Association (ASIA) Impairment Scale 216-217, 232 severity of injury 224 International Standards for Neurological Classification of Spinal Cord Injury 232 outcomes 256 amyloid precursor protein (APP) interventional therapy in impact-acceleration model 120 traumatic axonal injury 129, 147-148 anal sphincter reflex, animal models of spinal cord injury 257-258 animal models 114-122 axonal injury 140, 139-140, 143, 267 childhood TBI 127-132 limitations of using immature animals 132 clinical aspect selection 122 diffuse models 121 exercise-induced BDNF production 295 gender response to TBI 117, 122 hemorrhagic lesions 121 hypoxia 122 large animals 114, 119-121 controlled cortical impact 120 fluid percussion injury 119-120 impact-acceleration 120

inertial acceleration injury 120-121 spinal cord injury 253 locomotor training 306 multiple model use 121 NMDA receptor agonists 172-173 NMDA receptor antagonists 170-171, 175 deleterious effects 172 NMDA receptor dynamic changes 173-174 non-human primate spinal cord injury 260 plasticity 184 childhood 131-132 rodent 114-119, 121-122 closed head injury 116, 115-116 controlled cortical impact 118 cryogenic lesion 115 fluid percussion injury 117, 116–117, 118 impact-acceleration 118-119 optic nerve injury 115 spinal cord injury 253 species differences 121-122 spinal cord injury 252-260 autonomic function 257-258 behavioral tests 257 challenges 253-260 complete transection 253-254 compression lesion 256 contusion lesion 255, 256 decompression surgery 243-244 forelimb function 258 gray matter regions 259 hand function 258 hemisection 254-255 historical aspects 253 injury severity 259 large animals 253 lesion making 255-256 lesion paradigms 254 lesion type 253–256 locomotion 256-257 motor function 256-257 multiple models 259-260

nociception 259 non-human primates 260 outcome measures pain measurement 259 rodent 253 sensation measurement 259 therapeutic hypothermia 314, 315-317 thoracic injury 256-257 training therapy 295-296 visceral function 257-258 anti-inflammatory drugs, cerebral inflammation treatment 164 anxiety, mild TBI 45-46 ApoE epsilon 4 allele, TBI vulnerability 12 apoptosis animal models of childhood TBI 128 - 129spinal cord injury 280-281 neurons 280 oligodendrocytes 266, 267, 280-281 Arbeitsgemeinschaft fur Osteosynthese (AO) classification 233 thoraco-lumbar vertebral fractures 234 assault, traumatic brain injury 9 astrocytes activation 157 axon growth regulation 276 cerebral inflammation 157 function 276-277 generation by neural stem cells 283 glial scar formation 281 historical aspects 276 myelination promotion 276 neural progenitor cell differentiation 293 species differences 277 spinal cord injury 276-277 astrogliosis 157-158 closed head injury model 116 Atlanto-occipital dislocation, treatment 234-235 atlas fractures, treatment 235 attention deficit, mild TBI 48

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

brain-derived neurotrophic factor

autologous bone marrow cell implantation 284-285 autonomic dysreflexia 258 autonomic function, animal models of spinal cord injury 257-258 axis fractures, treatment 235 axolemma permeability 143-144 axon(s) demyelination 255, 264 growth 264 promotion 266-267 regulation 276 microtubules 146-147 myelin/myelination 145 NgR1 mediated degeneration 267 proteases 148 regeneration 264 inhibition by glial scar 281 inhibitors 264 macrophages 275-276 Schwann cells 285 regrowth inhibition chondroitin sulfate proteoglycan 264 molecular mechanisms 265-266 Nogo receptor signaling 267-268 swelling in traumatic axonal injury 143, 147-148 unmyelinated 145 axonal guidance molecules 264 axonal injury pathophysiology 266-267 see also diffuse axonal injury (DAI); traumatic axonal injury (TAI) axonal transport 146-147 Basso-Beattie-Bresnahan (BBB) locomotor rating scale 256, 314 behavioral deficits, impact-acceleration model 119 bicycle riding 5, 6 helmet wearing 8, 10 biocompatible implants, stem cell therapy combination 288-289 biofouling, microdialysis 88 biomarkers 82, 108, 103-108, 110 assays 109 blast injury 36-38 brain metabolism monitoring 75-76 cerebral ischemia 83 clinical validation 110 continuous flow-through ELISA 76 diagnostic platform development 109-110 events following TBI 109 microdialysis 85-86 mild TBI 106-107 moderate TBI 106-107 need for 103

neurointensive care 85-86 protein 107-108 severe traumatic brain injury 105 bladder function, animal models of spinal cord injury 257 blast injury 30 advanced combat helmet 38-39 biomarkers 36-38 body armor 31 classification 32, 33, 34 clinical signs 37 clinical spectrum 34, 32-34 definition 32 historical aspects 30-31 improvised explosive devices 31 mechanisms 31 mild 32, 33 moderate 33, 32-33 neuroimaging 32, 37-38, 63 personal protective equipment 38-39 prevalence amongst military personnel 31-32 severe 33, 33-34 traumatic axonal injury 38 traumatic brain injury 9 tympanic membrane 34, 37 vasospasm 38 blood/blood products, imaging 55-56 blood-brain barrier (BBB) disruption closed head injury model 116 fluid percussion injury model 119-120 body armor, blast injury 31 body-weight support (BWS) treadmill training 305, 308 bone marrow stem cells (BMSC) 283 autologous implantation 284-285 bone morphogenetic proteins (BMPs) 277 boxing 62 brain infarction, parenchymal damage 69 brain injury, secondary 205 brain metabolism monitoring 67-77 brain substrate delivery 69-73 functional monitoring 73-75 future neuroscience ICU design 77 glucose levels 84-85 industry input 77 insulin levels 84-85 low molecular weight cut-off microdialysis 83 methods 69-73 new technologies 75-77 brain oximetry, near-infrared spectroscopy 71-72 brain tract fibers, regeneration 310-311

(BDNF) animal models 295 cortical plasticity 186 endogenous production 295 inhibition 176 microglial 156-157 NMDA receptor stimulation 176 calcium animal models of childhood TBI 130 homeostasis in traumatic axonal injury 144-145 calcium-ATPase pump, traumatic axonal injury 144 calpain(s) 129 traumatic axonal injury 148 calpain inhibitors 149, 150 carbon nanotubes 76-77 caspases activation 128-129 spinal cord injury 281 traumatic axonal injury 148 CCL2 chemokine cerebral inflammation 162-163 CCR2 chemokine receptor 159 cell death animal models of childhood TBI 128-129 macrophage-induced 275-276 see also apoptosis cell transplantation macrophages activated 322 autologous 281 spinal cord injury 280-289 clinical trials 325 central cord syndrome 231 central nervous system (CNS) injury 275 regenerative capacity 264 central pattern generator (CPG) 294-295, 305-306 human spinal 307, 327 modulators 296 cerebral blood flow (CBF) animal models of childhood TBI 129-130 children 126 measurement 71 cerebral hypoperfusion, animal models of childhood TBI 130 cerebral inflammation 155-165 anti-inflammatory drugs 164 astrocytes 157 astrogliosis 157-158 CCL2 chemokine 162-163 chemokine inhibitors 164 chemokines 162-164

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

cerebral inflammation (cont.) circulating monocytes 159 CXCR2 chemokine receptor 163-164 glial scar 157-158 IL-1B 161 IL-6 161-162 IL-10 162 immunosuppressive drugs 164 inflammatory cytokines 160-162 macrophages 156, 160, 158-160, 164 microglia 156, 155-156, 157 neutrophils 156, 158, 163 therapeutic targeting 164 tumor necrosis factor 161 cerebral ischemia biomarkers 83 hyperglycemia 84-85 microdialysis critical levels 84 microdialysis markers 83 cerebral metabolism, animal models of childhood TBI 130-131 cerebral microdialysis see microdialysis Cerebral Oximeter 72 cerebral oxygenation monitoring 70-71, 95-96 cerebral perfusion pressure (CPP) children with therapeutic hypothermia 98 fluid percussion injury large animal model 119-120 maintenance 68 cervical spine injuries 224 lower 233-234 anterior fusion 235 decompressive surgery 235 facet dislocation 236-237 imaging 235 incomplete tetraplegia 236, 235-236 treatment 235-237 upper 232-233 Atlanto-occipital dislocation 234 - 235atlas fracture treatment 235 axis fracture treatment 235 multiple fracture treatment 235 treatment 234-235 Cethrin 325 chemokine(s) 162-164 chemokine inhibitors 164 child safety seats 8 children 126-132 age-dependent outcomes 126-127 amantadine hydrochloride therapy 126 animal models of TBI 127-132 cell death 128-129 cerebral blood flow 129-130

cerebral metabolism 130-131 cognitive function 127-128 glutamate receptors 129 histological alterations 128 limitations of using immature animals 132 neurodegeneration 128-129 neurofilament compaction 129 oxidative damage 131 plasticity 131-132 traumatic axonal injury 129 cerebral blood flow 126 cerebral metabolism after TBI 99-100 diffuse brain swelling 126 dopaminergic activity 126 energy expenditure after TBI 92-94 falls 8 glucose metabolism after TBI 95 hyperglycemia 95, 99 ketone uptake 95, 99 measured energy expenditure 93 mitochondrial dysfunction 126 neuroimaging 62 neurointensive care 126 non-accidental injury 10 nutrition after TBI 92-94 outcomes 126 PbO₂ 96-97, 99 road traffic injuries 10 therapeutic hypothermia 98-100 tight glucose control 99 traumatic brain injury low- and middle-income countries 22-23 outcomes 92 prevention 9-10 choline 60-61 chondroitin sulfate proteoglycan (CSPG) 187, 255, 264 astrocyte-derived 264, 276 axonal growth inhibition 264 digestion 297, 325 chondroitinase 297, 325 lithium chloride effects 325 chondroitinase ABC (ChABC) 298-300 clinical trials 192-203 adaptive randomization 195 ChinaSCINet 329, 328-329 clinical benefit proving in TBI 192-194 clinical outcomes 193 comparative effectiveness analysis 202, 201–202 covariate adjustment 197, 198, 200, 200 Cox regression 198

data collection standardization 200-201 DECRA trial 206 enrollment criteria 195, 197, 196 - 198heterogeneity covariate adjustment 198 imbalance risk 194-195 reduction 197 sample size calculations 195-196 IMPACT studies 194–195, 198 clinical trial design/analysis improvement 194 coding of data elements 201 data collection 200 linear regression 198 logistic regression 198 mega-trials 195 minimization 195 NMDA receptor antagonists 171-172, 175 detrimental effects 175 odds ratio 199 ordinal analysis 200 outcome 199 predictive factors 198 Phase I 192, 192 erythropoietin treatment 211-212 Phase II 192, 192 Phase III 192, 192 therapeutic hypothermia 210 Phase IV 192, 192 primary efficacy analysis 199-200 prognostic analysis 198 prognostic risk 196, 197-199 prognostic targeting 197, 197-198 proportional odds model 199, 200 randomization 195 relative study duration 196-197, 197 sample size 194-196 sliding dichotomy approach 199, 200 spinal cord injury 322-329 activated macrophage transplantation 322 decompressive surgery 246 neuroprotective therapies 322-324 neuroreparative therapies 322 regenerative therapies 322 rehabilitation 322, 325-327 therapeutic hypothermia 317-319 training therapy 325-327 study efficiency 196-198 systems biology 202 therapeutic hypothermia 208, 208-210 spinal cord injury 317-319 closed head injury rodent model NMDA receptor antagonists 170-171

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index

Index

blast injury 38, 63

connectivity measurement 59-60

TBI 116, 115-116 traumatic axonal injury 141-142 cognitive behavioral therapy (CBT), mild traumatic brain injury 49 cognitive decline, traumatic brain injury 3 cognitive function, children 127-128 collapsin response mediator protein-2 (CRMP-2) 265, 266 comparative effectiveness research (CER) 202, 201-202 compensation seeking, mild traumatic brain injury 46 computed tomography (CT) 54 blast injury 32, 37 diagnostic 104 computed tomography angiography (CTA), blast injury 38 concussion evaluation 34-35 post-concussional symptoms 44 continuing 44-46, 48 constraint-induced movement therapy (CIMT) 182-184 controlled cortical impact model cortical plasticity 187-188 hippocampal neurogenesis following TBI 186 large animal 120 NMDA receptor antagonists 171 rodent 118 traumatic axonal injury 140 contusion lesion, animal models childhood TBI 128-129 spinal cord injury 255, 256 cortex neural restructuring after lesions 183 plasticity 181-184, 186-188 functional 186-187 inhibitors 187 structural 188, 187-188 primary motor 182 cortical spreading depression (CSD) 74-75 see also spreading depolarization (SD) corticospinal tract (CST) fibers, sprouting/regeneration 266 corticosteroids see glucocorticoids CPP NMDA receptor antagonist, animal studies 171, 172 craniectomy, lateral 207 craniocervical fusion 235 craniotomy, hinged 207 creatinine 60-61 critical brain ischemia, reversal 68 cryogenic lesion rodent model 115 c-Tau biomarker 37 CX3CL1 chemokine 162

CX3CR1 chemokine receptor 162 production by circulating monocytes 159 CXCL1 chemokine 163 CXCL8 chemokine 158, 163, 164 CXCR2 chemokine receptor 163-164 cyclo-oxygenase 2 (COX-2), animal models of childhood TBI 131 cyclosporin A, traumatic axonal injury 149, 150 cytokines inflammatory in cerebral inflammation 160-162 microglial 156 D-CCP-ene, clinical trials 171-172 p-cycloserine (DCS) 176 animal models 172-173 decompressive craniectomy 205-207 decompressive surgery in spinal cord injury 8-hour time window 246 24-hour time window 245, 246 48-hour time window 246 72-hour time window 245-246 clinical evidence 244-246 clinical research 246 preclinical evidence 243-244 radiographic criteria 246-248 the rapeutic window 245–246 extension with hypothermia 316-317 DECRA trial 206 decompressive craniectomy brain injury mechanisms 206-207 Defense Veterans Brain Injury Center TBI Screening Tool 35 demyelination axons 255, 264 macrophage-induced 275 dendrites arborization 187 pruning 183 depression mild traumatic brain injury 48, 49 symptoms 36 traumatic brain injury 36 diffuse axonal injury (DAI) 138 neuroimaging 138 treatment 148-149 diffuse brain atrophy, infants 126 diffuse brain injury, animal models of childhood TBI 128 diffuse brain swelling, children 126 diffusion tensor imaging (DTI) 57, 56-57, 59 apparent diffusion coefficient 58

disability-adjusted life-years (DALYs), neurotrauma 17 dopaminergic activity, children 126 economic costs traumatic brain injury 3, 103 low- and middle-income countries 26 traumatic spinal cord injury 222 elderly people falls 8 traumatic spinal cord injury 216, 2.2.2 subdural hematoma 12 traumatic brain injury 11, 11–12 low- and middle-income countries 23 traumatic spinal cord injury 216, 2.2.2 electrocorticography (ECoG) 75, 74 - 75electroencephalogram (EEG), seizure monitoring 73-74 electromyography (EMG), spinal cord injury 307 embryonic stem cells 282 endothelial monocyte-activating polypeptide II precursor (EMAPII) 108 energy expenditure after TBI 92-94 enzyme-linked immunosorbent assay (ELISA) 76 ephrin(s) 264, 266 astrocyte-derived 276 ephrin-B3 265 epidural electrical stimulation 327 epilepsy, traumatic brain injury 35-36 erythropoietin 211-212 cerebral inflammation treatment 164 treatment of TBI 210-212 excitatory amino acids (EAA) 73 excitotoxicity glutamate-induced 170, 174-175 low molecular weight cut-off microdialysis 85-86 exercise therapy cellular transplant combination 298 pharmacotherapy combination 299 spinal cord injury 294-296, 298, 299, 327 facet dislocation 236-237 falls prevention 222 traumatic brain injury 8, 11–12

India 21

Cambridge University Press 978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index

More information

Index

falls (cont.) low- and middle-income countries 23, 27 Papua New Guinea 21 traumatic spinal cord injury 216, 222 characteristics 224 elderly people 222 Fas ligands 281 fiberoptic ICP monitors 69 fibroblasts, genetically modified 294 firearms 9 FK506, traumatic axonal injury 149, 150 fluid percussion injury model hippocampal neurogenesis following TBI 186 large animal 119-120 NMDA receptor antagonists 170, 171 rodent 117, 116-117, 118 traumatic axonal injury 141, 140-141 fluid-coupled ICP monitors 69 flumazenil PET 62 forelimb function, animal models of spinal cord injury 258 fractalkine see CX3CL1 chemokine gait neuronal mechanisms 306 standardized analysis 310 see also locomotion; walking gait training, robotic 308-310 gangliosides 324-325 GAP43 187 gender response to TBI animal models 122 lateral fluid percussion injury rodent model 117 Glasgow Coma Scale (GCS) 2, 67-69 functional monitoring 73 inaccuracy in severe TBI 105 limitations 104 Glasgow Outcome Scale (GOS) 193, 199 glial fibrillary acidic protein (GFAP) 37, 157, 158 glial scar 157-158, 276 astrocytes 281 proliferation 276 axonal regeneration inhibition 281 olfactory ensheathing glia implantation 285 glucocorticoids cerebral inflammation treatment 164 spinal cord injury 323 see also methylprednisolone glucose animal models of childhood TBI 130-131

brain level management 84-85 serum concentration measurement 95 glucose metabolism after TBI 94-95 glutamate binding site 169 biomarker 85-86 changes after brain injury 170 extracellular 170 stroke patients 174-175 glutamate antagonists, clinical trials 171, 174–176 glutamate receptors 169 animal models of childhood TBI 129 over-stimulation in TBI 170 glutathione peroxidase 131 glycemic control, neurointensive care 85 glycerol 73 biomarker 85-86 glycolysis, animal models of childhood TBI 130-131 gray matter injury animal models of spinal cord injury 259 mechanisms 55 gunshot wounds 9 Haddon matrix 26, 27 hand function, animal models of spinal cord injury 258 Hangman's fracture, treatment 235 Harris/Benedict equation 92-93, 93 helmets advanced combat helmet 38-39 occupational injury prevention 9 road traffic injury prevention 7-8, 10 sports injury prevention 8-9 high-income countries (HICs), TBI burden 19 high mobility group protein-1 (HMG-1) 186 hippocampus dendritic arborization matrix metalloproteinase 3 expression 185-186 neurogenesis following TBI 186 plasticity following TBI 184-186 homotopic cortex 181 HSP27 295 human spinal cord injury syndrome 252-253 hydrogels, biocompatible implants 288-289 5-hydroxytryptamine (5-HT) 299 central pattern generator modulation 296 hyperglycemia cerebral ischemia 84-85

children 95, 99 TBI outcomes 95 hyperglycolysis 94-95 animal models of childhood TBI 130 hyperthermia, spinal cord injury 314-315 hypotension, spinal cord injury 244 hypothermia, therapeutic spinal cord injury 314 animal models 314, 315-317 cervical 316, 318 clinical studies 317-319 complications 319 functional outcome 318, 318, 319 injury mechanisms 316 locomotor recovery 316 surgical intervention therapeutic window extension 316-317 systemic cooling strategies 316 ventral motor neuron preservation 317 systemic 316 [·]TBI 92, 97–99, 207–210 adverse effects 210 applications 99 children 98-100 Clifton study 208-210 clinical studies 208, 208-210 complications 210 early 98-99 equipment 209 experimental models 207-208 intracranial pressure control 209 meta-analyses 208, 210 multi-center Phase III trials 210 therapeutic window 208 traumatic axonal injury 149, 150 hypoxia animal models 122 impact-acceleration model 119 spinal cord injury 244 hypoxic-ischemic injury, neuroimaging in children 62 immune reactions innate immune response 272 neutrophils 272-274 microglia 155-157 spinal cord injury 281 immunosuppressive drugs cerebral inflammation 164 traumatic axonal injury 149, 150 IMPACT studies 194, 195, 198 clinical trial design/analysis improvement 194 coding of data elements 201 data collection 200 impact-acceleration model large animal 120

rodent 118-119

338

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index

More information

Index

improvised explosive devices (IEDs) 31 IN-1 monoclonal antibody 267-268, 325 induced pluripotent stem cells (iPSC) 286 inertial acceleration injury model 120-121 infants 126-127 inflammation glial scar 276 spinal cord injury 272-277, 324 astrocytes 276-277 macrophages 274-276, 277 neutrophils 272-274 see also cerebral inflammation information processing, mild TBI 48 innate immune response 272 neutrophils 272-274 insulin, brain level management 84-85 insulin therapy, tight glucose control 95 intercellular adhesion molecule 1 (ICAM-1) 274 intercellular adhesion molecule 1, soluble (sICAM-1) 162 interleukin 1B (IL-1B) 161 interleukin 6 (IL-6) 161-162 interleukin 8 (IL-8) see CXCL8 chemokine interleukin 10 (IL-10) 162 intracranial pressure (ICP) children with therapeutic hypothermia 98 control secondary brain injury prevention 205-206, 207 therapeutic hypothermia 209 decompressive craniectomy 206 epileptiform activity 74 fiberoptic monitors 69 fluid percussion injury large animal model 119-120 fluid-coupled monitors 69 impact-acceleration model 120 management 69 monitoring 69 pupillary change 75 severe blast injury 33-34 therapeutic hypothermia 98 ion homeostasis, traumatic axonal injury 144-145 jugular venous oxygen saturation (SjvO₂) 70

kainate receptors *173* ketone uptake in children's brains *95*, *99* kyphoplasty 239 kyphosis, thoracic spine injuries 237, 238 lactate/creatinine ratio 130 lactate/pyruvate ratio 61, 73 epileptiform activity 74 ischemia marker 83 microdialvsis 83-84 laser Doppler flowmetry 71 lateral fluid percussion injury rodent model 116-118 leg muscle activation 307-308, 308 legislation, traumatic brain injury prevention 10 leukocyte function-associated antigen (LFA-1) 159 leukocytes, migration/recruitment 162 LINGO-1 (LRR and Ig domain-containing Nogo receptor-interacting protein) 265 lithium chloride 325 litigation seeking, mild TBI 46 locomotion animal models of spinal cord injury 257, 256-257 central pattern generator 294-295, 305-306, 327 modulators 296 evaluation 256-257 hindlimb 294-295 leg muscle activation pattern 307-308 neuronal basis 305-306 neuronal mechanisms 306 rehabilitation goal 305 locomotor pattern, spinal cord injury 307, 308 locomotor recovery, spinal cord injury 325-327 locomotor training animal studies 306 CNS damage 307-308 essential cues 307-308 function recovery 308 loading 307 spinal cord injury 309, 305-309, 311 clinical trials 325-327 long-term depression, hippocampal plasticity 185 long-term potentiation D-cycloserine 176 hippocampal plasticity 185 low- and middle-income countries (LMICs) 17-18 African countries 19-20 age 23 burden 18-19 children 22-23

China 22 epidemiological studies 18-19 gender 23 India 20-21 Nepal 22 neurotrauma 17-27 Nigeria 19-20 Pakistan 20 Papua New Guinea 21 prevalence 23 Taiwan 22 traumatic brain injury 17-18 Vietnam 21-22 lumbar spine injuries, treatment 239 Ly6C (Gr1), production by circulating monocytes 159 macrophages autologous transplantation 281 axon regeneration 275-276 axon regrowth promotion 160 brain tissue damage 159 cell death 275-276 cerebral inflammation 156, 160, 158-160, 164 demyelination 275 function 274, 275-276 historical aspects 274-275 infiltration 158-159 M1 and M2 subsets 160, 159-160 neuronal toxicity 160 peripheral nerve repair 275 response onset/magnitude 275 species differences 276 spinal cord injury 274-276, 277, 285-286 stimulated 285-286 transplantation of activated 322 magnetic random access memory (MRAM) 76 magnetic resonance imaging (MRI) 54 blast injury 37 diagnostic 104 SPIO nanoparticle contrast agent 286-288 magnetic resonance imaging, functional (fMRI) 59-60 magnetic resonance spectroscopy (MRS) 60-61 blast injury 38 techniques 60 magnetoencephalography (MEG), blast injury 38 major depressive disorder, traumatic brain injury 36 matrix metalloproteinase 3 (MMP-3) 185-186

Cambridge University Press 978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

measured energy expenditure (MEE) 93 children 93 membrane phospholipid degradation, LMW cut-off microdialysis 85-86 membrane pumps, traumatic axonal injury 144 memory hippocampal plasticity 185 NMDA receptor association 173 mesenchymal stromal cells 283-284 spinal cord injury 283-285 SPIO nanoparticle-labeled 284, 288 metabolic crisis following TBI 83-84 metabotropic glutamate receptors (mGluRs) 169 methylprednisolone, clinical trials in spinal cord injury 322–324 methylprednisolone sodium succinate 243 microchip technology 77 microdialysis 72-73, 82-88 biofouling 88 biomarkers 85-86 combination with global monitoring techniques 86-87 critical levels in cerebral ischemia 84 extraction efficiency 87 fluid balance control 87-88 fluid recovery 87, 88 glucose brain level management 84-85 high molecular weight cut-off 87-88 insulin brain level management 84-85 lactate/pyruvate ratio 83-84 low molecular weight cut-off 83-87 excitotoxicity 85-86 ischemic energy metabolic crisis following TBI 83 limitations 86-87 membrane phospholipid degradation 85-86 metabolic monitoring 83 non-ischemic energy metabolic crisis following TBI 83-84 oxidative stress 85-86 protein recovery 87 relative recovery 87, 88 role 82 spreading depolarization 84 microglia 155-157 activation 155-156, 281 function 274 innate immune response 272 spinal cord injury 274, 281 Wallerian degeneration 274-275 see also macrophages

microglial antiporter system X_c⁻ 85 microprocessing 76 microtubule(s) 146-147 microtubule-associated proteins (MAPs) 146 mild traumatic brain injury (mTBI) 43 - 50anxiety association 45-46 attention deficit 48 biomarkers 106-107 causes 43 cerebral changes 44 clinical criteria 43 cognitive behavioral therapy 49 cognitive problem management 47 - 48compensation seeking 46 definition 43 demographic factors 45 depression 48, 49 diagnosis 43-44, 104 diagnostic biomarkers 107 diagnostic tools 104 genetic factors 45 homeopathy 47 information-processing problems 48 information provision for patients 46-47 initial screening 43-44 litigation seeking 46 management 46-47 multiple head injuries 45 neuroimaging 44, 107 neurological symptom treatment 47 neuronal damage 45 outcome 45 pathophysiology 44 pharmacological interventions 47 physical symptom treatment 47 post-concussional symptoms 44 continuing 44-46, 48 post-traumatic amnesia 43-44 pre-existing psychiatric disorder identification 47 psychological issues 48-50 PTSD association 45-46, 49 risk of repeated injury 106-107 sleep disorders 49 sports-related 50 symptom mastery 48-49 Military Acute Concussion Evaluation (MACE) 34-35 military personnel blast injury prevalence 31-32 personal protective equipment 38-39 TBI screening 34-35 minocycline, cerebral inflammation treatment 164

mitochondrial dysfunction animal models of childhood TBI 131 children 126 traumatic axonal injury 144-145 MK 801, animal studies 170, 172, 173 moderate traumatic brain injury (TBI) biomarkers 106-107 diagnostic tools 104 neuroimaging 107 risk of repeated injury 106-107 monocyte(s), circulating 159 monocyte chemotactic protein-1 (MCP-1) see CCL2 chemokine monosialic gangliosides (GM1) 324-325 motor cortex, reorganization after stroke 181 motorcycles helmet wearing 7-8 legislation 10, 22 traumatic brain injury 5 Nigeria 19-20 Taiwan 22 motor training 294 motor vehicle injuries see road traffic injuries movement patterns, neuronal networks 305 multi-frequency/-wavelength phase modulation 72 myelin inhibitors of neurite outgrowth, spinal cord injury 264-268 axonal regrowth inhibition 265-266 blockers 297 NgR1-mediated axonal degeneration 267 oligodendrocyte survival 266-267 myelin, traumatic axonal injury 145 myelin-associated glycoprotein (MAG) 265, 266 pharmacological inhibition 281 myelin-associated inhibitory factors (MAIF) 264-265 oligodendrocyte survival 266-267 myelination astrocytes 276 traumatic axonal injury 145 see also demyelination N-acetylaspartate (NAA) 60-61 Na/K ATPase pump 73 traumatic axonal injury 144 nanotechnology 76 nanowires 76-77 near-infrared spectroscopy (NIRS) 71 - 72neocortex, plasticity following TBI 186 - 188NEP1-40 268

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

nerve growth factor (NGF) cortical plasticity 186 microglial 156-157 netrins 264, 266 neural progenitor cells 293 neural stem cells 283 spinal cord injury 282-283 neurites myelin inhibitors of outgrowth in spinal cord injury 264-268 MAIFs 264-265 outgrowth regulation 266, 267-268 neurodegeneration, animal models of childhood TBI 128-129 neurofilaments compaction 129, 146 misalignment 146 traumatic axonal injury 145-146 neurogenesis, hippocampal following TBI 186 neuroglia see microglia neuroimaging blast injury 32, 37-38, 63 children 62 diagnostic 104 metabolism measurement 60-62 mild traumatic brain injury 44, 107 moderate traumatic brain injury 107 spinal cord compression 247 spinal cord injury 230, 246-248 SPIO nanoparticle contrast agent 286-288 sports injuries 62 technique development 54-63 see also named modalities neurointensive care children 126 improvement 83 neurological examination 67-69 assessment 73 neurological pupillary index (NPi) 75 neuron(s) apoptosis 280 migration regulation 266 neurofilaments 145-146 neuron-specific enolase (NSE) biomarker 37 neuronal circuit plasticity 295 neuronal death animal models of childhood TBI 128-129 traumatic axonal injury 148 neuronal networks, movement patterns 305 neuro-orthopedic instrumentation, traumatic spinal cord injury 230 neuroplasticity see plasticity

neurotrauma, low- and middle-income countries 17-27 African countries 19-20 age 23 alcohol consumption 24-25 burden 18-19 causes 24, 23-24 China 22, 26 control 26-27 DALYs 17 economic impact 26 elderly people 23 epidemiological studies 18-19 falls 23, 27 India 21 Papua New Guinea 21 gender 23 incidence 17 India 20-21, 24, 26 nature 25 Nepal 22 Nigeria 19-20 outcomes 25-26 Pakistan 20 Papua New Guinea 21 pediatric 22-23 prevalence 23 prevention 26-27 risk factors 25 road traffic injuries 23 alcohol consumption 24-25 severity 25 Taiwan 22, 26 pediatric injuries 22 trauma care 25 Vietnam 21-22 neurotrophic factor(s) (NTF) 292-294, 297 neurotrophic factor 3 (NT-3) 299 neutrophils activation 158, 273 bystander damage 273 cerebral inflammation 156, 158, 163 depletion 274 historical aspects 273-274 infiltration to damaged CNS 158 innate immune response 272-274 migration 273 post-spinal cord injury neurodegeneration 273 species variations 274 nicotinamide adenine dinucleotide (NADH) 77 N-methyl-D-aspartate (NMDA) animal models of childhood TBI 130 fragments 37 NR2A subunit 131 N-methyl-D-aspartate (NMDA) receptor(s) 169-177

animal models 173-174 BDNF release 176 blockade in recovery phase 176 channel function 169 dendrite pruning 183 dynamic changes 174 functions 176 hyperactivation 174 memory function 173 oligodendrocytes 281 subunits 173-174 synapse pruning 183 N-methyl-D-aspartate (NMDA) receptor agonists 172-173 N-methyl-D-aspartate (NMDA) receptor antagonists 170, 173 animal models 170-171, 175 deleterious effects 172, 175 clinical trials 171-172, 175 competitive 171-172 dendrite/synapse pruning prevention 183 non-competitive 170-171, 172 *N*-methyl-D-aspartate (NMDA) receptor channel pore 170 Nogo-A 265, 266, 325 axonal growth inhibition 267 function-blocking antibodies 268 high-affinity binding sites 268 pharmacological inhibition 267-268, 281 Nogo receptor (NgR) signaling complex 265-266 Nogo receptor 1 (NgR1) 265, 265, 297 axonal degeneration mediation 267 high-affinity binding sites 268 pharmacological inhibition 267-268 Nogo receptor 1 (310aa) ectodomain fused to Fc portion of IgG1 (NgR1(310)-Fc protein) 268 non-accidental injury children 10 neuroimaging 62 nutrition after TBI 92-94 occupational injuries traumatic brain injury 9 traumatic spinal cord injury 224 olfactory ensheathing glia (OEG) 285, 293-294 oligodendrocyte(s) apoptosis 266-267, 280-281 neural progenitor cell differentiation 293 NMDA receptors 281 survival 266-267 oligodendrocyte progenitor cells 282 oligodendrocyte-myelin glycoprotein

(OMgp) 265, 266

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index

More information

Index

oncomodulin 267 open skull impact/impulse injury model, traumatic axonal injury 140-141 optic nerve injury rodent model 115 traumatic axonal injury 142, 267 oxidative damage, animal models of childhood TBI 131 oxidative stress activated microglia 156 low molecular weight cut-off microdialysis 85-86 neutrophil production of free radicals 158 oxvgen cerebral monitoring 70-71, 95-96 device utilization 71 metabolism after TBI 95-97 oxygen tension, critical threshold values 70 oxygenation, tissue 69-71 p75^{NTR} 265-266 pain measurement, animal models of spinal cord injury 259 partial pressure of interstitial brain oxygen (PbO₂) 96-97 children 96-97, 99 management of levels 96 penile erection, animal models of spinal cord injury 257-258 pentose phosphate pathway (PPP) 84 peri-infarct depolarization (PID) 74 peripheral nerve grafts, spinal cord injury 294 peripheral nervous system 275 personal protective equipment (PPE) 38-39 plasticity 180-188 adult 180 animal models of TBI 184 childhood 131-132 CNS lesions 307 cortical 181-184, 186-188 functional 186-187 inhibitors 187 structural 188, 187-188 critical period 180 dendrite pruning 183 developmental 180 following TBI 184-188 hippocampal 184-186 mechanisms 306-307 microarray studies 184-185 neocortical 186-188 rehabilitation 305 spinal cord injury structural 181-184 synapse pruning 183

poloxamer 188, traumatic axonal injury treatment 143-144 poly-ADP-ribose polymerase (PARP) 130 poly(lactic acid-co-glycolic acid) (PLGA) 289 polylysine-poly(ethylene glycol) (PEG) 289 polymorphonucleocyte (PMNL), post-traumatic hypothermia effects 316 positron emission tomography (PET) 61-62 blast injury 37-38, 63, 63 flumazenil 62 Post Deployment Health Assessments (PDHA) 35 post-concussional symptoms (PCS) 44 continuing 44-46, 48post-traumatic amnesia (PTA) 43-44 post-traumatic stress disorder (PTSD) biomarker for TBI discrimination 36 - 37definition 35 depression co-morbidity 36 diagnostic criteria 35 mild TBI association 45-46, 49 overlap with traumatic brain injury 30, 36 pathophysiology 35 preconditioning 36 symptoms 36 productivity loss 3 proteases, traumatic axonal injury 148 protein biomarkers 107-108 PtiO₂ cerebral oxygenation monitoring 70-71 pupillometers 75 pyruvate dehydrogenase (PDH) 131 quantum dots 76-77 quipazine 299 quisqualate receptors 173 randomized controlled trial (RCT) 192, 327-328 rapid stretch injury in vivo model, traumatic axonal injury 142-143 reactive oxygen species (ROS), microglial 156 recreational injuries, TBI 8-9 rehabilitation in spinal cord injury clinical trials 322, 325-327 epidural electrical stimulation 327 monitoring progress 310 neuronal plasticity 305

resting energy expenditure (REE)

92-93

retinal ganglion cells, optic nerve crush 267 Rho guanosine triphosphatases (Rho-GTPases) 265, 266 RhoA pathway 297 RhoA-GTP 265 road traffic injuries airbags 7 alcohol consumption 6, 7 low- and middle-income countries 24-25 child safety seats 8 children 10 economic cost 3 low- and middle-income countries 26 economic status of country 5-6 helmets 7-8 low- and middle-income countries 23 African countries 19-20 China 22 economic cost 26 India 20-21, 24 Nigeria 19-20 Pakistan 20 Papua New Guinea 21 risk factors 25 Taiwan 22 Vietnam 21-22 prevention 7-8 low- and middle-income countries 26-27 strategy effectiveness 10 seat belts 7 speed 7 traumatic brain injury 4, 6, 4-6, 8 traumatic spinal cord injury 216, 222 characteristics 224 trends in injuries 5-6 robotic gait training 308-310 rotational-acceleration injury model, traumatic axonal injury 139-140 S100ß serum biomarker 37 Schwann cells 285 seat belts, road traffic injury prevention 7 second impact syndrome 106-107

secondary brain injury 205 seizures cortical spreading depression co-occurrence 74–75 monitoring 73–74 traumatic brain injury 35–36 self-harm, traumatic brain injury 9 Selfotel, clinical trials *171* semaphorin(s) 264, 266

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

semaphorin-4D 265 sensation measurement, animal models of spinal cord injury 259 severe traumatic brain injury (TBI) accident scene management 105 alcohol intoxication 105 biomarker use 105 brain tissue swelling 209 diagnostic biomarkers 104-105, 106 diagnostic tools 104 erythropoietin clinical trial 211-212 Glasgow Coma Scale inaccuracy 105 single-photon emission tomography (SPECT), blast injury 37-38 sleep disorders, traumatic brain injury 36 mild 49 slits 264, 266 social costs, traumatic spinal cord injury 222 sodium channels, traumatic axonal injury 144 aII-spectrin breakdown products 37 spinal cord antero-posterior (AP) diameter 247 electrical stimulation of lumbosacral cord 327 hemorrhage 247 intramedullary edema 247 regeneration 310-311 swelling 247 spinal cord compression 231, 242 cervical 248, 247-248 definition using MRI measures 247 imaging 247 spinal cord injury, traumatic acute injury cellular transplants 293 environmental modification 297 exercise/training 295 methylprednisolone treatment 323 age distribution 221, 221-222 animal models 243-244, 252-260 autonomic function 257-258 behavioral tests 257 challenges 253-260 complete transection 253-254 compression lesion 256 contusion lesion 255, 256 forelimb function 258 gray matter regions 259 hand function 258 hemisection 254-255 historical aspects 253 injury severity 259 large animals 253 lesion making 255-256

lesion paradigms 254 lesion type 253-256 locomotion 257, 256-257 motor function 256-257 multiple models 259-260 nociception 259 non-human primates 260 outcome measures 256-260 pain measurement 259 rodent 253 sensation measurement 259 thoracic injury 256-257 visceral function 257-258 apoptosis 280-281 neurons 280 oligodendrocytes 266-267, 280-281 associated disorders 252 astrocytes 276-277 burden 252 causes 223, 222-223, 224 cell death 280-281 cellular transplants 280-289, 292-294 activated macrophages 322 acute injury 293 autologous macrophages 281 chronic injury 293-294 clinical trials 325 exercise combination 298 pharmacotherapy combination 298, 298-299 subchronic injury 293 cervical cord 224 characteristics 224 chronic injury 292 cellular transplants 293-294 environmental modification 297 scar formation 297 training therapy 295-296 classification systems 232-234 neurological deficit 232 spine injuries 232-234 clinical trials 322-329 activated macrophage transplantation 322 cell transplantation 325 decompressive surgery 246 locomotor training 325-327 neuroprotective therapies 322-324 neuroreparative therapies 324-325 regenerative therapies 322, 324-325 rehabilitation 322, 325-327 therapeutic hypothermia 317-319 training therapy 325-327

complete 324 locomotor training 326 complications 252 contusion 315 definition 216-217 demographics 220-222 diagnosis 216-217 disease frequency measures 217-220 economic costs 222 electromyography 307 environmental modification 297 epidemiology 216-225, 252 etiology 223, 222-223, 224 exercise therapy 294-296, 327 cellular transplant combination 298 pharmacotherapy combination 299 falls 222 characteristics 224 elderly people 216, 222 features 252 genetically modified fibroblasts 294 GM1 therapy 324-325 healthcare 224 human injury syndrome 252-253 hyperthermia 314-315 hypotension 244 hypoxia 244 imaging 230, 246-248 immune component 281 incidence 219, 217-219, 219 prevention measures 219 regional differences 218, 217-218 temporal differences 218-219, 220 incomplete 224, 308, 324 inflammation 272-277, 324 astrocytes 276-277 macrophages 274-276, 277 neutrophils 272-274 initial assessment 230-231 neurological 224 injury types 252 instrumented spinal fixation techniques 244 kyphoplasty 239 level 224 localized cord cooling 315 locomotor ability 308 locomotor pattern 307, 308 locomotor recovery 325-327 locomotor training 309, 305-309, 311 clinical trials 325-327 lumbar spine injuries 239 macrophages 274-276, 277 management priorities 231 microglia 274, 281 mortality 242

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

spinal cord injury, traumatic (cont.) motor training 294 myelin inhibitors of neurite outgrowth 264-268 blockers 297 neural pathway sparing 306 neural progenitor cells 293 neurological damage 229 neurological deficit classification 232 neurological recovery 247 neuronal plasticity neuro-orthopedic instrumentation 230 neuroprotective agents 243, 322-324 neuroreparative therapies 324-325 neurotrophic factors 292-294, 297 neutrophils 272-274 occupational injury prevention 224 olfactory ensheathing glia 285, 293-294 pathology 242-243 pathophysiology 280-281 peripheral nerve grafts 294 prevalence 219-220 prevention measures 222-224 incidence 219 primary 243, 242-243, 280 prognosis 229 prognostic factors 247 regenerative therapies 322, 324-325 rehabilitation clinical trials 322, 325-327 monitoring progress 310 neuronal plasticity 305 road traffic injuries 216, 222 characteristics 224 prevention 222 robotic gait training 308–310 secondary 242, 243, 243, 280-281 contusion lesions 255 mesenchymal stromal cells 284 secondary damage avoidance 229 severity 221, 224 sex differences 221, 222 signaling cascade of down stream events 243 social costs 222 spine injuries classification 232-234 subchronic injury cellular transplants 293 environmental modification 297 exercise/training 295 surgical approaches 229-230 temperature management 314-319 temperature rise 314-315 training therapy 294-296 clinical trials 325-327 optimizing 310 use-dependent activity 295

treatment 229, 242, 292-300 cellular transplants 292-294, 298, 298-299 cement injection 239 combination therapies 298, 297-298, 300 complications prevention 240 conservative 234-240 environmental modification 297 exercise therapy 294-296, 298, 299, 327 historical milestones 229-230 initial 230-231 intraoperative neuromonitoring 240kyphoplasty 239 lower cervical spine 235-237 lumbar spine injuries 239 medical approaches 230 neuroprotective agents 243, 322-324 neuroreparative therapies 324-325 peri operative spinal cord injury prevention 240 pharmacological targets 296-297 pharmacotherapy with cellular transplants 298, 298-299 pharmacotherapy with exercise 299 regenerative therapies 322, 324-325 rehabilitation 305, 310, 322, 325 - 327stem cell therapy 280, 281-289 surgical 230-231, 234-240 thoracic spine 237-239 thoraco-lumbar spine 239 training therapy 294-296, 310, 325-327 transmitter-related 296 transplantation/exercise/ pharmacotherapy 299-300 upper cervical spine 234-235 vertebroplasty 239 untreatable injury 229 vertebroplasty 239 see also cervical spine injuries; decompressive surgery in spinal cord injury; hypothermia, therapeutic; stem cell therapy, spinal cord injury; thoracic spine injuries; thoraco-lumbar spine injuries spinal fixation techniques, instrumented 244 sports injuries, traumatic brain injury 8-9 children 22-23

high-impact 62 mild 50 spreading depolarization (SD) 84 see also cortical spreading depression (CSD) STASCIS (Surgical Trial in Acute Spinal Cord Injury Study) 246 stem cell(s) multipotent 281 mesenchymal stromal cells 283 neural stem cells 282 pluripotent 281 embryonic stem cells 282 induced 286 totipotent 281 stem cell therapy, spinal cord injury 280, 281-289 biocompatible implant combination 288-289 combined therapy 288-289 embryonic stem cells 282 induced pluripotent stem cells 286 interventions 289 mesenchymal stromal cells 284, 283-284, 285, 288 neural stem cells 282-283 olfactory ensheathing glia 285 Schwann cells 285 SPIO nanoparticles for monitoring 286-288 stimulated macrophages 285-286 stepping, newborn movements 307 stress 36 stroke constraint-induced movement therapy 182-184 cortical plasticity 187 function recovery 181-184 rehabilitation 183-184, 187 subarachnoid hemorrhage, severe blast injury 33-34 Subaxial Injury Classification (SLIC) 233, 233-234 subcortical white matter, metabolism 61 - 62subdural hematoma, elderly people 12 substance abuse, TBI 36 superparamagnetic iron-oxide (SPIO) nanoparticles 286-288 mesenchymal stromal cell labeling 284, 288 suppressor of cytokine signaling 3 (SOC3) 276 survivors of TBI 2 susceptibility weighted imaging (SWI) 55 - 56synapses, pruning 183 synaptophysin 187 systems biology 202

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index More information

Index

c-Tau biomarker 37 temperature management in spinal cord injury see also hypothermia, therapeutic temperature rise, TBI 314-315 terrorist attacks 9 tetraplegia, incomplete 236, 235-236 thermal dilution flow probes 71 thoracic spine injuries animal models of spinal cord injury 256-257 kyphosis 237, 238 mini-transthoracic approach 239 stabilization 237-239 thoracoscopic approach 239 treatment 237-239 Thoraco-Lumbar Injury Classification (TLIC) 234, 233-234 thoraco-lumbar spine injuries 239 vertebral fractures 3-column model of Denis 234 classification 234 Magerl-AO classification 234 tight glucose control 95 children 99 tissue injury 272 tissue oxygenation 69-71 toddlers 126-127 tractography 59 traffic-related injuries see road traffic injuries training therapy in spinal cord injury 294-296, 305-311 animal models 295-296 clinical trials 325-327 disadvantages 296 gait training 296 optimizing 310 use-dependent activity 295 transforming growth factor β $(TGF-\beta)$, microglial 156-157 trauma care 25, 27 see also neurotrauma, low- and middle- income countries traumatic axonal injury animal models 140, 267 impact-acceleration model 118 optic nerve injury model 115 traumatic axonal injury (TAI) 38, 138 - 150β-amyloid precursor protein 147-148 animal models 139-143 childhood TBI 129 closed skull impact injury 141 - 142controlled cortical impact 140

fluid percussion injury 141, 140-141 open skull impact/impulse injury 140-141 optic nerve stretch injury 142 rapid stretch injury in vivo 142-143 rotational-acceleration injury 139-140 axolemma permeability 143-144 axonal swellings 143 calpains 148 caspases 148 chronic phase 139 definition 138 diffusion tensor imaging 58 hypothermia treatment 149, 150 imaging 54 immunosuppressive drugs 149, 150 ion homeostasis 144-145 mechanisms 138-139 microglial clusters 55 microtubules 146-147 myelin/myelination 145 neurofilaments 145-146 neuronal cell death 148 pathobiology 143-148 poloxamer 188 treatment 143-144 progressive 55 proteases 148 TBI pathophysiology 55 treatment 149, 148-150 traumatic brain injury (TBI) admission criteria 2 age in low- and middle-income countries 23 ageing society 11, 11-12 assault 9 biochemical pathways 103 causes 3, 4, 5 low- and middle-income countries 23-24 cellular event cascade 68 children low- and middle-income countries 22-23 outcomes 92 prevention 9-10 classification 1-2, 33, 32-33, 34, 82 limitations 104 closed 32, 33 cognitive decline 3 community surveys 2 consequences 35-36 CT diagnosis limitations 104 definition 1-2, 18, 33, 32-33, 34 depression 36 diagnostic tools 104 economic costs 3, 103

low- and middle-income countries 26 elderly people, low- and middleincome countries 23 epidemiology 1-12, 103 epilepsy 35-36 falls 8, 11–12 India 21 low- and middle-income countries 27 Papua New Guinea 21 gender, low- and middle-income countries 23 high-income countries, burden 19 human cost 2-3 incidence 1, 2, 5, 20 injury pattern 114 microstructural integrity 58-59 morbidity 2 mortality 2, 3, 35, 82 occupational injuries 9 outcomes 2-3, 92 children 126 clinical interventions 205 low- and middle-income countries 25-26 management 105 pathobiology 103 pathophysiology 54-55, 67 penetrating 32, 33 personal protective equipment 38-39 prevalence 2 low- and middle-income countries 23 military personnel 31-32 prevention 3, 3-4 in children 9-10 legislation 10 low- and middle-income countries 26-27 strategy effectiveness 10 productivity loss 3 recreational injuries 8-9 referral patterns 2 screening in military personnel 34-35 self-harm 9 severity 2, 104 low- and middle-income countries 25 sleep disorders 36 stress 36 substance abuse 36 survivors 2 temperature rise 314-315 treatment decompressive craniectomy 205-207

978-1-107-53471-1 - Traumatic Brain and Spinal Cord Injury: Challenges and Developments Edited by Cristina Morganti-Kossmann, Ramesh Raghupathi and Andrew Maas Index

More information

Index			

traumatic brain injury (TBI) (cont.) erythropoietin 164, 210-212 future perspectives 205-212 trends 3 road traffic injuries 5-6 see also blast injury; falls; hypothermia, therapeutic; mild traumatic brain injury (mTBI); moderate traumatic brain injury (TBI); neurotrauma, low- and middle-income countries; road traffic injuries; severe traumatic brain injury (TBI) traxoprodil, clinical trials 172 treadmill training body-weight support 305, 308 clinical trials 326 manually assisted 308-309

robotic/robot-assisted 308–310 TROY signal transducing receptor 265 tumor necrosis factor (TNF) 161 tympanic membrane, blast injury 34, 37

ubiquitin C-terminal hydrolase L1 (UCH-L1) 108

vasogenic edema, cryogenic lesion rodent model 115 vasospasm, blast injury 38 vertebroplasty 239 violence assault 9 neurotrauma in low- and middle-income countries 23–24 war-related in India 21 visceral function, animal models of spinal cord injury 257–258

walking evaluation 256–257 recovery 326–327 rehabilitation goal 305 Wallerian degeneration *146* calpains microglia 274–275 oligodendrocyte apoptosis 266–267 war-related violence, India 21 Warrior Administered Retrospective Casualty Assessment Tool (WARCAT) 34 white matter injury, mechanisms 55 Wnts 264