

# Contents

<b>Videos</b> .....	xvii
<b>Foreword</b> .....	xix
<i>Ali A. Baaj</i>	
<b>Foreword</b> .....	xxi
<i>Alexander R. Vaccaro</i>	
<b>Preface</b> .....	xxiii
<b>Acknowledgments</b> .....	xxv
<b>Contributors</b> .....	xxvii

## Part I: Preoperative Considerations

<b>1. Relevant Spine Anatomy for Regional Anesthesia</b> .....	3
<i>Ernest E. Braxton Jr. and Colin Gold</i>	
<b>1.1 Introduction</b> .....	3
<b>1.2 Lumbar Spine Anatomy</b> .....	3
1.2.1 Bones and Disks .....	3
1.2.2 Ligaments .....	4
1.2.3 Nerves .....	4
1.2.4 Muscles .....	5
<b>1.3 Types of Blocks</b> .....	5
<b>1.3.1 Spinal</b> .....	5
<b>1.3.2 Epidural</b> .....	7
<b>1.3.3 Erector Spinae Plane Block</b> .....	9
<b>1.4 Technique</b> .....	9
<b>1.5 Conclusions</b> .....	9
<b>References</b> .....	10
<b>2. Basics of Ultrasound</b> .....	11
<i>Bhavuk Garg, Punit Khanna, and Bhavana Kayarat</i>	
<b>2.1 Sound Wave: General Physical Principles</b> .....	11
<b>2.2 Interaction of Ultrasound Waves with Tissues</b> .....	12
<b>2.3 Generation of Ultrasound Beam</b> .....	13
2.3.1 Piezoelectric Effect .....	13
<b>2.3.2 Transducers</b> .....	13
<b>2.4 Ultrasound Imaging Modalities</b> .....	15
2.4.1 Doppler Effect .....	15
<b>2.5 Conclusion</b> .....	16
<b>Suggested Readings</b> .....	17

<b>3. Overview of Regional Anesthesia</b> .....	19		
<i>Stephen Davies, Emily Zoe Barney Hall, Jeffrey C. Gadsden, and W. Michael Bullock</i>			
<b>3.1 Introduction</b> .....	19	3.2.6	Classical Transversus Abdominis Plane Block..... 21
<b>3.2 Blocks for Spine Surgery</b> .....	20	<b>3.3</b>	<b>Benefits of Regional Anesthesia for Awake Spine Surgery</b> .....
3.2.1 Spinal.....	20	<b>3.4</b>	<b>Conclusion</b> .....
3.2.2 Epidural.....	20		<b>References</b> .....
3.2.3 Paravertebral Blocks .....	21		
3.2.4 Erector Spinae Plane Block ....	21		
3.2.5 Quadratus Lumborum Block... ..	21		
<b>4. Erector Spinae Plane Blocks</b> .....	25		
<i>Emily Zoe Barney Hall and W. Michael Bullock</i>			
<b>4.1 Introduction</b> .....	25	4.3.1	Data for General Anesthesia in Spine Surgeries..... 27
<b>4.2 Erector Spinae Plane Block</b> ....	25	4.3.2	Data for Awake Spine Surgery .. 28
4.2.1 Relevant Anatomy .....	25	<b>4.4</b>	<b>Clinical Example</b> .....
4.2.2 Block Function.....	25	<b>4.5</b>	<b>Conclusion</b> .....
4.2.3 Block Performance.....	26		<b>References</b> .....
<b>4.3 Erector Spinae Plane Data</b> .....	27		
<b>5. Anesthesia for Awake Spinal Surgeries—Epidural vs. Spinal Anesthesia</b> .....	31		
<i>Anjaleekrishna K. and Bikash Ranjan Ray</i>			
<b>5.1 Introduction</b> .....	31	<b>5.5</b>	<b>Comparison of Neuraxial Procedures and General Anesthesia</b> .....
<b>5.2 Mechanism of Action</b> .....	31	<b>5.6</b>	<b>Safety Profile</b> .....
5.2.1 Spinal Anesthesia .....	31	<b>5.7</b>	<b>Complications and Adverse Events</b> .....
5.2.2 Epidural Anesthesia.....	32	<b>5.8</b>	<b>Current Trends in Anesthesia Choice</b> .....
5.2.3 Patient Selection.....	33	<b>5.9</b>	<b>Future of Regional Anesthesia in Spine Surgeries</b> .....
<b>5.3 Managing Awareness during Surgery</b> .....	33		<b>References</b> .....
<b>5.4 Comparison of Efficacy between Epidural and Spinal Anesthesia</b> .....	34		

<b>6. Paravertebral Blocks for Lumbar Spine</b> .....	39		
<i>Armaan R. Patel, Nabil Matmati, and Vijay Yanamadala</i>			
<b>6.1 Introduction</b> .....	39	<b>6.3.1 Local Anesthetic Systemic Toxicity</b> .....	47
<b>6.2 Paravertebral Blocks</b> .....	40	<b>6.3.2 Nerve Injury</b> .....	47
6.2.1 Cervical Blocks .....	40	<b>6.3.3 Inadvertent Puncture</b> .....	47
6.2.2 Thoracic Blocks .....	42	<b>6.4 Conclusion</b> .....	47
6.2.3 Lumbar Blocks .....	44	<b>References</b> .....	48
6.2.4 Sacral Blocks .....	46		
<b>6.3 Safety Issues</b> .....	47		
<b>7. Paravertebral Blocks for Cervical Spine</b> .....	49		
<i>Debesh Bhoi, Ashwin M., and Sukriti Jha</i>			
<b>7.1 Introduction</b> .....	49	<b>7.7 Cervical Paravertebral Block</b> ...	54
<b>7.2 Cervical Paraspinal Interspinal Plane Blocks</b> .....	50	7.7.1 Introduction .....	54
7.2.1 Introduction .....	50	7.7.2 Relevant Anatomy .....	54
7.2.2 Relevant Anatomy .....	50	7.7.3 Technique .....	55
7.2.3 Technique .....	51	7.7.4 Clinical Use for Cervical Spine Surgery .....	55
7.2.4 Clinical Applications .....	52	7.7.5 Limitations and Complications .....	56
7.2.5 Summary .....	52	<b>7.8 Cervical Plexus Block</b> .....	56
<b>7.3 Cervical Erector Spinae Plane Block</b> .....	52	7.8.1 Introduction .....	56
7.3.1 Introduction .....	52	7.8.2 Relevant Anatomy .....	56
7.3.2 Relevant Anatomy .....	52	7.8.3 Technique .....	56
<b>7.4 Technique</b> .....	53	7.8.4 Clinical Use for Cervical Spine Surgery .....	58
<b>7.5 Clinical Applications of the Cervical ESP Block</b> .....	54	7.8.5 Limitations and Complications .....	58
<b>7.6 Potential Complications of the Cervical ESP Block</b> .....	54	<b>7.9 Conclusion</b> .....	58
		<b>References</b> .....	58
<b>8. Abdominal Wall Blocks</b> .....	61		
<i>Stephen Davies and W. Michael Bullock</i>			
<b>8.1 Introduction</b> .....	61	8.2.1 Background .....	62
<b>8.2 Quadratus Lumborum Block</b> ...	62	8.2.2 Anatomy .....	62
		8.2.3 Variations .....	63

8.2.4	Block Coverage .....	64	8.3.3	Variations .....	66
8.2.5	Block Technique .....	65	8.3.4	Block Coverage .....	67
8.2.6	Application in Spine Surgery .....	66	8.3.5	Block Technique .....	67
<b>8.3</b>	<b>Transversus Abdominis Plane Block</b> .....	66	8.3.6	Application in Spine Surgery .....	68
8.3.1	Background .....	66	<b>8.4</b>	<b>Case Example</b> .....	69
8.3.2	Anatomy .....	66	<b>References</b> .....		69
<b>9.</b>	<b>Patient Anxiety in Awake Spine Surgery</b> .....	71			
	<i>Arnav Sharma and Basma Mohamed</i>				
<b>9.1</b>	<b>Introduction</b> .....	72	<b>9.5</b>	<b>Pharmacological Interventions for Perioperative Management of Patient Anxiety</b> .....	75
<b>9.2</b>	<b>Factors Contributing to Anxiety in Awake Spine Surgery</b> .....	72	9.5.1	Benzodiazepines .....	75
9.2.1	Fear of Pain and Being Awake .....	72	9.5.2	Alpha-2 Agonists .....	77
9.2.2	Inadequate Information and Communication .....	73	9.5.3	Propofol .....	78
9.2.3	Influence of the Clinical Environment .....	73	9.5.4	Ketamine .....	79
9.2.4	Demographic and Psychological Factors .....	73	9.5.5	Gabapentin .....	79
<b>9.3</b>	<b>Implications of Anxiety on Perioperative Outcomes</b> .....	73	<b>9.6</b>	<b>Preoperative Evaluation and Consideration for Patients with Anxiety before Awake Spine Surgery</b> .....	80
<b>9.4</b>	<b>Nonpharmacological Interventions for Perioperative Management of Patient Anxiety</b> .....	74	9.6.1	The Role of Preoperative Patient Education and Counseling .....	80
9.4.1	Music Therapy .....	74	9.6.2	Methods of Delivering Education .....	81
9.4.2	Virtual Reality .....	74	9.6.3	Counseling and Psychological Support .....	81
9.4.3	Progressive Muscle Relaxation and Guided Imagery .....	74	<b>9.7</b>	<b>Patient Anxiety in the Postoperative Phase of Care after Awake Spine Surgery</b> .....	82
9.4.4	Hypnosis and Cognitive Behavioral Therapy .....	75	<b>9.8</b>	<b>Clinical Example</b> .....	82
9.4.5	Aromatherapy and Massage .....	75	<b>9.9</b>	<b>Conclusion and Future Directions</b> .....	83
			<b>References</b> .....		83

<b>10. General Anesthesia—Not Just Going to Sleep</b> .....	87		
<i>Maya Blasingame and Amanda H. Kumar</i>			
<b>10.1 Introduction</b> .....	87	<b>10.4.3 Airway Injury</b> .....	90
<b>10.2 Cardiovascular Effects of General Anesthesia</b> .....	88	<b>10.4.4 Hypothermia</b> .....	90
<b>10.3 Respiratory Effects of General Anesthesia</b> .....	88	<b>10.4.5 Awareness under Anesthesia</b> ..	90
<b>10.4 Other Complications of General Anesthesia</b> .....	89	<b>10.4.6 Adverse Drug Reactions</b> .....	91
<b>10.4.1 Postoperative Nausea and Vomiting</b> .....	89	<b>10.4.7 Cognitive Dysfunction</b> .....	91
<b>10.4.2 Malignant Hyperthermia</b> .....	89	<b>10.5 Risk Profile of Anesthetic Techniques</b> .....	91
		<b>10.6 Conclusion</b> .....	91
		<b>References</b> .....	91
<b>11. Lessons from COVID-19 and Lower and Medium Income Countries—Egypt</b> .....	93		
<i>Mohamed Fawzy Khattab</i>			
<b>11.1 Introduction</b> .....	93	<b>11.9 Postoperative Care</b> .....	97
<b>11.2 COVID-19 and Spine Surgery</b> ...	94	<b>11.10 Postoperative Recovery</b> .....	97
<b>11.3 Egyptian Experience during the COVID-19 Pandemic</b> .....	94	<b>11.11 Perioperative Complications</b> ...	97
<b>11.4 Advantages of Spine Surgery under Spinal Anesthesia</b> .....	95	<b>11.12 Clinical Cases</b> .....	97
<b>11.5 Limitations</b> .....	95	<b>11.12.1 Case 1</b> .....	97
<b>11.6 Preoperative Considerations</b> ...	95	<b>11.12.2 Case 2</b> .....	99
<b>11.7 Equipment and Medications</b> ...	95	<b>11.13 Conclusion</b> .....	99
<b>11.8 Intraoperative Management</b> ...	95	<b>References</b> .....	99
<b>12. Lessons from COVID-19 and Lower and Medium Income Countries—India</b> .....	101		
<i>Bhavana Kayarat, Punit Khanna, and Bhavuk Garg</i>			
<b>12.1 Introduction</b> .....	101	<b>12.4 Intraoperative Concerns</b> .....	103
<b>12.2 Advantages of Regional Anesthesia in Spine Surgery</b> ...	102	<b>12.4.1 Blood Loss</b> .....	103
<b>12.3 Preoperative Concerns of Awake Spinal Surgery</b> .....	103	<b>12.4.2 Position-Related Complications</b> ..	104
		<b>12.4.3 Peripheral Nerve Injury</b> .....	104
		<b>12.4.4 Pain Management</b> .....	104
		<b>12.4.5 Epidural Anesthesia</b> .....	104

12.4.6	Intrathecal Morphine . . . . .	104	<b>12.6</b>	<b>Lessons from COVID-19: Our Experience with Awake Spine Surgeries . . . . .</b>	<b>106</b>
12.4.7	Epidural Steroid . . . . .	104			
12.4.8	Erector Spinae Block . . . . .	104			
12.4.9	Pharmacological Agents . . . . .	105		<b>References . . . . .</b>	<b>107</b>
<b>12.5</b>	<b>Enhanced Recovery after Surgery Protocol in Spine Surgery . . . . .</b>	<b>105</b>			
<b>13.</b>	<b>Developing an Outpatient Awake Spine Surgery Program . . . . .</b>	<b>109</b>			
	<i>Alok Sharan</i>				
<b>13.1</b>	<b>Introduction . . . . .</b>	<b>109</b>	<b>13.5</b>	<b>Aftercare for Patient after Outpatient Spine Surgery . . . . .</b>	<b>111</b>
<b>13.2</b>	<b>Definition . . . . .</b>	<b>109</b>	<b>13.6</b>	<b>Protocol Development . . . . .</b>	<b>112</b>
<b>13.3</b>	<b>Preparing the Patient for Outpatient Spine Surgery . . . . .</b>	<b>109</b>	<b>13.7</b>	<b>Conclusion . . . . .</b>	<b>112</b>
<b>13.4</b>	<b>Intraoperative Considerations . . . . .</b>	<b>111</b>		<b>References . . . . .</b>	<b>112</b>

**Part II: Intraoperative Considerations**

<b>14.</b>	<b>Advances in Minimally-Invasive Techniques—A Brief Introduction . . . . .</b>	<b>115</b>			
	<i>Arnav Sharma, Peter N. Drossopoulos, and Muhammad M. Abd-El-Barr</i>				
<b>14.1</b>	<b>Introduction to Minimally Invasive Spine Surgery . . . . .</b>	<b>115</b>	<b>14.4</b>	<b>Awake Endoscopy . . . . .</b>	<b>118</b>
<b>14.2</b>	<b>Awake Robotic Surgery . . . . .</b>	<b>116</b>	14.4.1	Emergence . . . . .	118
14.2.1	Emergence . . . . .	116	14.4.2	Indications . . . . .	118
14.2.2	Indications . . . . .	116	14.4.3	Pros . . . . .	118
14.2.3	Pros . . . . .	116	14.4.4	Cons . . . . .	119
14.2.4	Cons . . . . .	116	<b>14.5</b>	<b>Awake Lateral Fusions . . . . .</b>	<b>119</b>
<b>14.3</b>	<b>Next-Generation Transforaminal Lumbar Interbody Fusions . . . . .</b>	<b>117</b>	14.5.1	Emergence . . . . .	119
14.3.1	Emergence . . . . .	117	14.5.2	Pros . . . . .	119
14.3.2	Indications . . . . .	117	14.5.3	Cons . . . . .	120
14.3.3	Pros . . . . .	117	<b>14.6</b>	<b>Conclusion . . . . .</b>	<b>120</b>
14.3.4	Cons . . . . .	118		<b>References . . . . .</b>	<b>120</b>
<b>15.</b>	<b>Awake Robotic Surgery . . . . .</b>	<b>123</b>			
	<i>Maya Blasingame, Kingsley Abode-Iyamah, and Elird Bojaxhi</i>				
<b>15.1</b>	<b>History of Spinal Fusion Surgery . . . . .</b>	<b>123</b>	<b>15.2</b>	<b>History of Intraoperative Imaging . . . . .</b>	<b>124</b>

15.2.1	Intraoperative X-ray.....	124	15.4.1	General Benefits .....	126
15.2.2	Intraoperative Ultrasound.....	124	15.4.2	Specific Benefits .....	127
15.2.3	Intraoperative CT and Image Guidance .....	125	15.4.3	Limitation .....	127
<b>15.3</b>	<b>Evolution of Robotic Surgery...</b>	125	<b>15.5</b>	<b>Conclusion.....</b>	128
<b>15.4</b>	<b>Awake Robotic Spine Surgery..</b>	126		<b>References.....</b>	128
<b>16.</b>	<b>Next Generation TLIFs.....</b>	129			
	<i>Alyssa M. Bartlett, Peter N. Drossopoulos, and Muhammad M. Abd-El-Barr</i>				
<b>16.1</b>	<b>Introduction .....</b>	129	16.4.1	History and Innovation.....	133
<b>16.2</b>	<b>Open Transforaminal Lumbar Interbody Fusion .....</b>	130	16.4.2	Key Steps .....	134
16.2.1	History and Innovation.....	130	16.4.3	Outcomes.....	134
16.2.2	Key Steps .....	131	16.4.4	Limitations .....	134
16.2.3	Limitations .....	131	<b>16.5</b>	<b>Transfacet Lumbar Interbody Fusion .....</b>	135
<b>16.3</b>	<b>Minimally Invasive Transforaminal Lumbar Interbody Fusion .....</b>	131	16.5.1	History and Innovation.....	135
16.3.1	History and Innovation.....	131	16.5.2	Key Steps .....	135
16.3.2	Key Steps .....	132	16.5.3	Outcomes.....	136
16.3.3	Outcomes .....	132	16.5.4	Limitations .....	136
16.3.4	Limitations .....	133	<b>16.6</b>	<b>Conclusions.....</b>	136
<b>16.4</b>	<b>Trans-Kambin's Triangle Lumbar Interbody Fusion .....</b>	133		<b>References.....</b>	137
<b>17.</b>	<b>Awake Endoscopic Spine Surgery.....</b>	139			
	<i>Devin St. Clair and Raymond Gardocki</i>				
<b>17.1</b>	<b>Introduction .....</b>	139	<b>17.7</b>	<b>Airway Management .....</b>	141
<b>17.2</b>	<b>Pros.....</b>	140	<b>17.8</b>	<b>Anesthesia Protocol .....</b>	143
<b>17.3</b>	<b>Cons.....</b>	141	<b>17.9</b>	<b>Adjuncts.....</b>	144
<b>17.4</b>	<b>Indications.....</b>	141	<b>17.10</b>	<b>Postoperative.....</b>	144
<b>17.5</b>	<b>Methods.....</b>	141	<b>17.11</b>	<b>Conclusion.....</b>	144
<b>17.6</b>	<b>Patient Positioning.....</b>	141		<b>References.....</b>	145

<b>18. Awake Lateral Fusion</b> .....	147		
<i>Georgios Bakaloudis, Alice Baroncini, Michele Bochicchio, Lorenzo D'Apice, Alessandra Isidori, and Angelo Mazzarino</i>			
<b>18.1 Introduction</b> .....	147	<b>18.6 Results</b> .....	150
<b>18.2 Indications</b> .....	148	<b>18.7 Case Example</b> .....	150
<b>18.3 Anesthesia</b> .....	148	<b>18.8 Conclusion</b> .....	151
<b>18.4 Surgical Technique</b> .....	148	<b>References</b> .....	151
<b>18.5 Postoperative Management</b> ...	149		

### Part III: Postoperative Considerations

<b>19. Long-Acting Nerve Block Pumps for Postoperative Pain Management</b> .....	155
<i>Ernest E. Braxton Jr. and Andrew Lucic</i>	

<b>19.1 Introduction</b> .....	155	<b>19.5 Pump Types for Acute Pain Management</b> .....	157
<b>19.2 Continuous Infusion Catheters</b> ..	155	<b>19.6 Conclusion</b> .....	158
<b>19.3 Blocks Amenable to Continuous Infusions</b> .....	156	<b>References</b> .....	160
<b>19.4 Catheter Types for Continuous Anesthesia Pumps</b> .....	157		

<b>20. Postoperative Delirium and Awake Spine Surgery</b> .....	161
<i>Favour C. Ononogbu-Uche, Felix Toussaint, Taylor Wallace, Abdullah Wael Saleh, and Chakib Maurice Ayoub</i>	

<b>20.1 Introduction</b> .....	161	<b>20.2.2 Epidemiology and Incidence</b> ...	163
<b>20.1.1 Definition of Postoperative Delirium</b> .....	161	<b>20.2.3 Pathophysiology and Risk Factors</b> .....	163
<b>20.1.2 Overview of Awake Spine Surgery</b> .....	162	<b>20.2.4 Diagnosis and Assessment Tools</b> .....	164
<b>20.1.3 Importance of Understanding the Relationship</b> .....	162	<b>20.3 Awake Spine Surgery: An Overview</b> .....	164
<b>20.2 Understanding Postoperative Delirium</b> .....	162	<b>20.3.1 Definition and Techniques</b> ....	164
<b>20.2.1 Clinical Features</b> .....	162	<b>20.3.2 Indications and Contraindications</b> .....	165
		<b>20.3.3 Benefits and Challenges</b> .....	165

20.3.4	Comparison with Traditional Spine Surgery.....	165	20.7.1	Emerging Techniques in Awake Spine Surgery.....	169
<b>20.4</b>	<b>Mechanisms Linking Awake Spine Surgery and Postoperative Delirium.....</b>	<b>165</b>	20.7.2	Advances in Delirium Prevention and Management ..	169
20.4.1	Neurophysiological Mechanisms.....	165	20.7.3	Ongoing Research and Clinical Trials.....	169
20.4.2	Pain Management and Delirium.....	165	<b>20.8</b>	<b>Clinical Example.....</b>	<b>169</b>
20.4.3	Perioperative Factors.....	166	20.8.1	Patient Background .....	169
<b>20.5</b>	<b>Clinical Studies and Evidence... ..</b>	<b>166</b>	<b>20.9</b>	<b>Preoperative Considerations ...</b>	<b>169</b>
20.5.1	Review of Key Studies .....	166	<b>20.10</b>	<b>Operative Course.....</b>	<b>170</b>
20.5.2	Outcomes, Complications, and Best Practices.....	167	<b>20.11</b>	<b>Postoperative Course.....</b>	<b>171</b>
20.5.3	Impact on Readmission Rates ..	167	<b>20.12</b>	<b>Outcome .....</b>	<b>171</b>
20.5.4	Best Practices .....	168	<b>20.13</b>	<b>Conclusion.....</b>	<b>171</b>
<b>20.6</b>	<b>Prevention and Management Strategies .....</b>	<b>168</b>	20.13.1	Summary of Key Points.....	171
20.6.1	Preoperative Assessment and Optimization .....	168	20.13.2	Clinical Implications .....	171
<b>20.7</b>	<b>Future Directions and Research.....</b>	<b>169</b>	20.13.3	Call for Continued Research and Education .....	171
			<b>References.....</b>	<b>172</b>	
<b>21.</b>	<b>Evidence for Awake Spine Surgery .....</b>	<b>175</b>			
	<i>Shaun E. Gruenbaum and Kingsley Abode-Iyamah</i>				
<b>21.1</b>	<b>Introduction .....</b>	<b>175</b>	21.3.7	Postoperative Nausea and Vomiting .....	181
<b>21.2</b>	<b>Historical Context.....</b>	<b>176</b>	21.3.8	Anesthesia, Surgical, and Operating Room Times .....	182
<b>21.3</b>	<b>Benefits of Awake Spine Surgery.....</b>	<b>177</b>	21.3.9	Deep Vein Thrombosis.....	182
21.3.1	Safety of Awake Spine Surgery..	179	21.3.10	Blood Loss .....	183
21.3.2	Hemodynamic Effects .....	179	21.3.11	Hospital Length of Stay.....	183
21.3.3	Postoperative Pain and Analgesic Requirements .....	180	21.3.12	Postanesthesia Care Unit Admission Times .....	183
21.3.4	Surgeon Satisfaction .....	180	21.3.13	Urinary Retention.....	184
21.3.5	Patient Satisfaction.....	181	21.3.14	Time to Mobilization .....	184
21.3.6	Costs and Carbon Footprint....	181	21.3.15	Fatigue and Quality of Life .....	184
			21.3.16	Cognition.....	184

<b>21.4 Practical Considerations and Perioperative Approach</b> . . . . .	184	<b>21.6 Emergency Airway Management</b> . . . . .	190
21.4.1 Patient Selection. . . . .	185	21.6.1 Risks of Airway Compromise . .	190
21.4.2 Surgical Indications. . . . .	185	21.6.2 Airway Management. . . . .	191
21.4.3 Spinal Technique . . . . .	186	<b>21.7 Establishing an Awake Spine Program</b> . . . . .	192
21.4.4 Preemptive Analgesia . . . . .	186	21.7.1 Establishing an Anesthetic Protocol . . . . .	192
21.4.5 Perioperative Sedation. . . . .	187	<b>21.8 Conclusions</b> . . . . .	192
<b>21.5 Challenges and Additional Considerations</b> . . . . .	187	<b>References</b> . . . . .	192
21.5.1 Challenging Spinal Insertion. . .	187		
21.5.2 Complications of Spinal Anesthesia . . . . .	188		
21.5.3 Potential Drawbacks of Awake Spine Surgery . . . . .	188		
<b>22. Beyond General Anesthesia: The Protocols Powering Awake Spine Surgery</b> . . . . .	197		
<i>Shahenda Khedr, Kingsley Abode-Iyamah, Benjamin Frederick Gruenbaum, and Marie De Ruyter</i>			
<b>22.1 Introduction</b> . . . . .	197	22.5.1 Anesthesia Protocol: Intraoperative . . . . .	204
<b>22.2 Patient Selection</b> . . . . .	198	22.5.2 Airway Management. . . . .	205
<b>22.3 Surgical Selection</b> . . . . .	199	<b>22.6 Postoperative Course</b> . . . . .	208
22.3.1 Patient Selection Criteria for Spinal Procedures. . . . .	199	22.6.1 Anesthesia Protocol: Postoperative. . . . .	208
<b>22.4 Preoperative Course</b> . . . . .	201	22.6.2 Management . . . . .	209
22.4.1 Positioning . . . . .	202	<b>22.7 Conclusion</b> . . . . .	209
22.4.2 Anesthesia Protocol: Preoperative. . . . .	203	<b>References</b> . . . . .	209
<b>22.5 Intraoperative Course</b> . . . . .	204		
<b>Index</b> . . . . .	211		