



# Contents

<i>Preface to the Fifth Edition</i>	xxvii
<i>List of Editors</i>	xxviii
<i>List of Contributors</i>	xxix
<i>Acknowledgments</i>	l
<i>Dedication</i>	li

## Volume One: Principles

**edited by Geoffrey C. Gurtner and Andrea L. Pusic**

<b>1 Plastic surgery and innovation in medicine</b>	1
<i>Peter C. Neligan</i>	
<b>2 History of reconstructive and aesthetic surgery</b>	9
<i>Riccardo F. Mazzola and Isabella C. Mazzola</i>	
<b>3 Applying psychology to routine plastic surgery practice</b>	24
<i>Nichola Rumsey and Alex Clarke</i>	
<b>4 The role of ethics in plastic surgery and medico-legal issues in plastic surgery</b>	32
<i>Michele A. Manahan and B. Aviva Preminger</i>	
<b>5 Business principles for plastic surgeons</b>	37
<i>C. Scott Hultman</i>	
<b>6 Value-based healthcare</b>	60
<i>Justin M. Broyles, Clifford C. Sheckter, and Anaeze C. Offodile 2nd</i>	
<b>7 Digital photography in plastic surgery</b>	66
<i>Daniel Z. Liu</i>	
<b>8 Pre- and intra-operative imaging for plastic surgery</b>	83
<i>Arash Momeni and Lawrence Cai</i>	
<b>9 Patient safety in plastic surgery</b>	94
<i>Jessica Erdmann-Sager and Christopher J. Pannucci</i>	
<b>10 Anesthesia and pain management in plastic surgery</b>	101
<i>Paul N. Afrooz and Franklyn P. Cladis</i>	
<b>11 Evidence-based medicine and health services research in plastic surgery</b>	115
<i>Sophocles H. Voineskos, Lucas Gallo, Andrea L. Pusic, and Achilleas Thoma</i>	
<b>12 Patient-reported outcomes in plastic surgery</b>	135
<i>Sophocles H. Voineskos, Danny Young-Afat, Madelijn Gregorowitsch, Jonas A. Nelson, Anne F. Klassen, and Andrea L. Pusic</i>	
<b>13 Health services research in plastic surgery</b>	146
<i>Jacqueline N. Byrd and Kevin C. Chung</i>	
<b>14 Principles of cancer management</b>	153
<i>Stav Brown and Babak J. Mehrara</i>	
<b>15 Wound healing</b>	163
<i>Kristo Nuutila, David E. Varon, and Indranil Sinha</i>	
<b>16 Scar prevention, treatment, and revision</b>	186
<i>Michelle F. Griffin, Evan Fahy, Michael S. Hu, Elizabeth R. Zielins, Michael T. Longaker, and H. Peter Lorenz</i>	

<b>17 Skin grafting</b>	206
<i>Shawn Loder, Benjamin Levi, and Audra Clark</i>	
<b>18 Tissue engineering</b>	220
<i>Ramin Shayan and Karl-Anton Harms</i>	
<b>19 Repair, grafting, and engineering of cartilage</b>	235
<i>Wei Liu, Guangdong Zhou, and Yilin Cao</i>	
<b>20 Repair and grafting of bone</b>	265
<i>Iris A. Seitz, Chad M. Teven, Bryce Hendren-Santiago, and Russell R. Reid</i>	
<b>21 Repair and grafting of peripheral nerve</b>	295
<i>Hollie A. Power, Kirsty Usher Boyd, Stahs Pripotnev, and Susan E. Mackinnon</i>	
<b>22 Repair and grafting fat and adipose tissue</b>	309
<i>J. Peter Rubin</i>	
<b>23 Vascular territories</b>	321
<i>Steven F. Morris and G. Ian Taylor</i>	
<b>24 Flap physiology, classification, and applications</b>	346
<i>Joon Pio Hong and Peter C. Neligan</i>	
<b>25 Principles and techniques of microvascular surgery</b>	414
<i>Fu-Chan Wei, Sherilyn Keng Lin Tay, and Nidal F. Al Deek</i>	
<b>26 Tissue expansion and implants</b>	442
<i>Britta A. Kuehlmann, Eva Brix, and Lukas M. Prantl</i>	
<b>27 Principles of radiation therapy</b>	452
<i>Stephanie K. Schaub, Joseph Tsai, and Gabrielle M. Kane</i>	
<b>28 Lymphedema: pathophysiology and basic science</b>	472
<i>Stav Brown, Michelle Coriddi, and Babak J. Mehrara</i>	
<b>29 Benign and malignant nonmelanocytic tumors of the skin and soft tissue</b>	490
<i>Rei Ohtsuka</i>	
<b>30 Melanoma</b>	521
<i>Sydney Chung and Alexander H.R. Valey</i>	
<b>31 Implants and biomaterials</b>	544
<i>Dharshan Sivaraj, Dominic Henn, Timothy W. King, and Kellen Chen</i>	
<b>32 Transplantation in plastic surgery</b>	555
<i>Yannick F. Diehm, Valentin Haug, Martin Kauke-Navarro, and Bohdan Pomahac</i>	
<b>33 Technology innovation in plastic surgery: a practical guide for the surgeon innovator</b>	568
<i>David Perrault, Leila Jazayeri, and Geoffrey C. Gurtner</i>	
<b>34 Robotics in plastic surgery</b>	582
<i>Karim A. Sarhane and Jesse C. Selber</i>	
<b>35 Digital technology in plastic surgery</b>	594
<i>Lynn Jeffers, Hatem Abou-Sayed, and Haley M. Jeffers</i>	
<b>36 Aesthetic improvement through noninvasive technologies</b>	613
<i>Stelios C. Wilson and Charles H. Thorne</i>	
<b>37 Education and teaching in plastic surgery</b>	619
<i>Lydia Helliwell and Johanna N. Riesel</i>	

<b>38</b>	<b>Global plastic surgery</b>	<b>625</b>	<b>9.5</b>	<b>Facelift: Platysma-SMAS plication</b>	<b>203</b>
	<i>Johanna N. Riesel, Peter Nthumba, George Ho, and Amanda Gosman</i>			<i>Miles G. Berry, James D. Frame III, and Dai M. Davies</i>	
<b>39</b>	<b>Gender-affirming surgery</b>	<b>634</b>	<b>9.6</b>	<b>Facelift: Lateral SMASectomy facelift</b>	<b>212</b>
	<i>Shane D. Morrison, William M. Kuzon Jr., and Jens U. Berli</i>			<i>Daniel C. Baker and Steven M. Levine</i>	
<i>Index</i>		<i>652</i>	<b>9.7</b>	<b>Facelift: The extended SMAS technique in facial rejuvenation</b>	<b>219</b>
				<i>James M. Stuzin</i>	
<b>Volume Two: Aesthetic</b>					
<i>edited by J. Peter Rubin and Alan Matarasso</i>					
<b>1</b>	<b>Managing the aesthetic surgery patient</b>	<b>1</b>	<b>9.8</b>	<b>High SMAS facelift: combined single flap lifting of the jawline, cheek, and midface</b>	<b>236</b>
	<i>Michelle B. Locke and Foad Nahai</i>			<i>Timothy Marten and Dino Elyassnia</i>	
<b>2</b>	<b>Principles of practice management and social media for cosmetic surgery</b>	<b>13</b>	<b>9.9</b>	<b>The lift-and-fill facelift</b>	<b>282</b>
	<i>Ashley N. Amalfi, Josef G. Hadeed, and Smita R. Ramanadham</i>			<i>Stav Brown, Justin L. Bellamy, and Rod J. Rohrich</i>	
<b>Section I: Aesthetic Anesthesia Techniques</b>					
<b>3</b>	<b>Essential elements of patient safety in aesthetic plastic surgery</b>	<b>18</b>	<b>9.10</b>	<b>Neck rejuvenation</b>	<b>301</b>
	<i>Jeremy T. Joseph, Gabriele C. Miotto, Felmont F. Eaves III, and Galen Perdikiis</i>			<i>James E. Zins and Jacob Grow</i>	
<b>4</b>	<b>Pain management in plastic surgery</b>	<b>25</b>	<b>9.11</b>	<b>Male facelift</b>	<b>319</b>
	<i>Anna R. Schoenbrunner and Jeffrey E. Janis</i>			<i>Timothy Marten and Dino Elyassnia</i>	
<b>5</b>	<b>Anatomic blocks of the face and neck</b>	<b>33</b>	<b>9.12</b>	<b>Secondary facelift irregularities and the secondary facelift</b>	<b>345</b>
	<i>Stelios C. Wilson and Barry Zide</i>			<i>Timothy Marten and Dino Elyassnia</i>	
<b>6</b>	<b>Local anesthesia</b>	<b>42</b>	<b>9.13</b>	<b>Perioral rejuvenation, including chin and genioplasty</b>	<b>390</b>
	<i>Malcolm D. Paul</i>			<i>Ali Totonchi and Bahman Guyuron</i>	
<b>Section II: Aesthetic Surgery of the Face</b>					
<b>7</b>	<b>Non-surgical skin care and rejuvenation</b>	<b>47</b>	<b>9.14</b>	<b>Facial feminization</b>	<b>404</b>
	<i>Zoe Diana Draelos</i>			<i>Patrick R. Keller, Matthew Louis, and Devin Coon</i>	
<b>8.1</b>	<b>Editors' perspective: injectables and non-surgical resurfacing techniques</b>	<b>53</b>	<b>10</b>	<b>Editors' perspective: brow and eye</b>	<b>424</b>
	<i>J. Peter Rubin</i>			<i>Alan Matarasso</i>	
<b>8.2</b>	<b>Injectables and resurfacing techniques: Soft-tissue fillers</b>	<b>54</b>	<b>11</b>	<b>Forehead rejuvenation</b>	<b>425</b>
	<i>Kavita Mariwalla</i>			<i>Richard Warren</i>	
<b>8.3</b>	<b>Injectables and resurfacing techniques: Botulinum toxin/neurotoxins</b>	<b>73</b>	<b>12</b>	<b>Endoscopic brow lift</b>	<b>441</b>
	<i>Rawaa Almukhtar and Sabrina G. Fabi</i>			<i>Renato Saltz and Eric W. Anderson</i>	
<b>8.4</b>	<b>Injectables and resurfacing techniques: Lasers in aesthetic surgery</b>	<b>84</b>	<b>13</b>	<b>Blepharoplasty</b>	<b>453</b>
	<i>Jonathan Cook, David M. Turer, Barry E. DiBernardo, and Jason N. Pozner</i>			<i>Julius Few Jr., and Marco Ellis</i>	
<b>8.5</b>	<b>Injectables and resurfacing techniques: Chemical peels</b>	<b>96</b>	<b>14</b>	<b>Secondary blepharoplasty</b>	<b>484</b>
	<i>Richard H. Bensimon and Peter P. Rullan</i>			<i>Carl Z. Aschen and Henry M. Spinelli</i>	
<b>8.6</b>	<b>Minimally invasive multimodal facial rejuvenation</b>	<b>118</b>	<b>15</b>	<b>Asian facial cosmetic surgery</b>	<b>513</b>
	<i>Luiz S. Toledo</i>			<i>Jong Woo Choi, Tae Suk Oh, Hong Lim Choi, and Clyde Ishii</i>	
<b>9.1</b>	<b>Editors' perspective: surgical facial rejuvenation</b>	<b>130</b>	<b>16</b>	<b>Facial fat grafting</b>	<b>559</b>
	<i>Alan Matarasso</i>			<i>Francesco M. Egro, Sydney R. Coleman, and J. Peter Rubin</i>	
<b>9.2</b>	<b>Facial anatomy and aging</b>	<b>131</b>	<b>17</b>	<b>Editors' perspective: nose</b>	<b>567</b>
	<i>Bryan Mendelson and Chin-Ho Wong</i>			<i>Alan Matarasso</i>	
<b>9.3</b>	<b>Principles and surgical approaches of facelift</b>	<b>149</b>	<b>18</b>	<b>Nasal analysis and anatomy</b>	<b>568</b>
	<i>Richard J. Warren</i>			<i>Rod J. Rohrich and Paul N. Afrooz</i>	
<b>9.4</b>	<b>Facelift: Facial rejuvenation with loop sutures: the MACS lift and its derivatives</b>	<b>180</b>	<b>19</b>	<b>Open technique rhinoplasty</b>	<b>581</b>
	<i>Patrick Tonnard, Alexis Verpaele, and Rotem Tzur</i>			<i>Rod J. Rohrich and Paul N. Afrooz</i>	
			<b>20</b>	<b>Closed technique rhinoplasty</b>	<b>607</b>
				<i>Mark B. Constantian</i>	
			<b>21</b>	<b>Airway issues and the deviated nose</b>	<b>647</b>
				<i>Ali Totonchi, Bryan Armijo, and Bahman Guyuron</i>	
			<b>22</b>	<b>Secondary rhinoplasty</b>	<b>662</b>
				<i>David M. Kahn, Danielle H. Rochlin, and Ronald P. Gruber</i>	
			<b>23</b>	<b>Otoplasty and ear reduction</b>	<b>681</b>
				<i>Charles H. Thorne</i>	
			<b>24</b>	<b>Hair restoration</b>	<b>690</b>
				<i>Alfonso Barrera and Victor Zhu</i>	

**Section III: General Aesthetic Surgery**

<b>25.1</b>	<b>Editors' perspective: liposuction</b>	<b>700</b>
	<i>J. Peter Rubin</i>	
<b>25.2</b>	<b>Liposuction: a comprehensive review of techniques and safety</b>	<b>701</b>
	<i>Gianfranco Frojo, Jayne Coleman, and Jeffrey Kenkel</i>	
<b>25.3</b>	<b>Correction of liposuction deformities with the SAFE liposuction technique</b>	<b>723</b>
	<i>Simeon H. Wall Jr. and Paul N. Afrooz</i>	
<b>26</b>	<b>Editors' perspective: abdominal contouring</b>	<b>731</b>
	<i>Alan Matarasso</i>	
<b>27</b>	<b>Abdominoplasty</b>	<b>732</b>
	<i>Alan Matarasso</i>	
<b>28</b>	<b>Lipoabdominoplasty with anatomical definition: a new concept in abdominal aesthetic surgery</b>	<b>775</b>
	<i>Oswaldo Ribeiro Saldanha, Andrés F. Canchica Cano, Taisa Szolomicki, Oswaldo Saldanha Filho, and Cristianna Bonetto Saldanha</i>	
<b>29</b>	<b>Editors' perspective: truncal contouring</b>	<b>785</b>
	<i>J. Peter Rubin</i>	
<b>30</b>	<b>Bra-line back lift</b>	<b>786</b>
	<i>Joseph Hunstad and Saad A. Alsubaie</i>	
<b>31</b>	<b>Belt lipectomy</b>	<b>792</b>
	<i>Amitabh Singh and Al S. Aly</i>	
<b>32</b>	<b>Circumferential approaches to truncal contouring in massive weight loss patients: the lower lipo-bodylift</b>	<b>819</b>
	<i>Dirk F. Richter and Nina Schwaiger</i>	
<b>33</b>	<b>Circumferential approaches to truncal contouring: autologous buttocks augmentation with purse-string gluteoplasty</b>	<b>834</b>
	<i>Joseph P. Hunstad and Nicholas A. Flugstad</i>	
<b>34</b>	<b>Circumferential approaches to truncal contouring: lower bodylift with autologous gluteal flaps for augmentation and preservation of gluteal contour</b>	<b>841</b>
	<i>Robert F. Centeno and Jazmina M. Gonzalez</i>	
<b>35.1</b>	<b>Editors' perspective: buttock augmentations</b>	<b>854</b>
	<i>J. Peter Rubin</i>	
<b>35.2</b>	<b>Buttock augmentation with implants</b>	<b>855</b>
	<i>Jose Abel De la Peña Salcedo, Jocelyn Celeste Ledezma Rodriguez, and David Gonzalez Sosa</i>	
<b>35.3</b>	<b>Buttock shaping with fat grafting and liposuction</b>	<b>869</b>
	<i>Constantino G. Mendieta, Thomas L. Roberts III, and Terrence W. Bruner</i>	
<b>36</b>	<b>Upper limb contouring</b>	<b>878</b>
	<i>Margaret Luthringer, Nikita O. Shulzhenko, and Joseph F. Capella</i>	
<b>37</b>	<b>Medial thigh</b>	<b>891</b>
	<i>Samantha G. Maliha and Jeffrey Gusenoff</i>	
<b>38</b>	<b>Post-bariatric reconstruction</b>	<b>898</b>
	<i>Jonathan W. Toy and J. Peter Rubin</i>	
<b>39</b>	<b>Energy devices in aesthetic surgery</b>	<b>919</b>
	<i>David Turer, Jonathan Cook, Jason Pozner, and Barry DiBernardo</i>	
<b>40</b>	<b>Aesthetic genital surgery</b>	<b>926</b>
	<i>Gary J. Alter</i>	

**Volume Three: Craniofacial, Head and Neck Surgery and Pediatric Surgery**

**Part 1: Craniofacial, Head and Neck Surgery:** edited by Richard A. Hopper

<b>1</b>	<b>Management of craniomaxillofacial fractures</b>	<b>2</b>
	<i>Srinivas M. Susarla, Russell E. Ettinger, and Paul N. Manson</i>	
<b>2</b>	<b>Scalp and forehead reconstruction</b>	<b>39</b>
	<i>Alexander F. Mericli and Jesse C. Selber</i>	
<b>3</b>	<b>Aesthetic nasal reconstruction</b>	<b>52</b>
	<i>Frederick J. Menick</i>	
<b>4</b>	<b>Auricular construction</b>	<b>110</b>
	<i>Dale J. Podolsky, Leila Kasrai, and David M. Fisher</i>	
<b>5</b>	<b>Secondary treatment of acquired cranio-orbital deformities</b>	<b>138</b>
	<i>Allan B. Billig and Oleh M. Antonyshyn</i>	
<b>6.1</b>	<b>Computerized surgical planning: introduction</b>	<b>155</b>
	<i>Richard A. Hopper</i>	
<b>6.2</b>	<b>Three-dimensional virtual planning in orthognathic surgery</b>	<b>157</b>
	<i>Pradip R. Shetye and Srinivas M. Susarla</i>	
<b>6.3</b>	<b>Computerized surgical planning in head and neck reconstruction</b>	<b>173</b>
	<i>Maureen Beederman, Adam S. Jacobson, David L. Hirsch, and Jamie P. Levine</i>	
<b>7</b>	<b>Introduction to post-oncologic reconstruction</b>	<b>188</b>
	<i>Zoe P. Berman and Eduardo D. Rodriguez</i>	
<b>8</b>	<b>Overview of head and neck soft-tissue and bony tumors</b>	<b>190</b>
	<i>Sydney Ch'ng, Edwin Morrison, Pratik Rastogi, and Yu-Ray Chen</i>	
<b>9</b>	<b>Post-oncologic midface reconstruction: the Memorial Sloan-Kettering Cancer Center and MD Anderson Cancer Center approaches</b>	<b>217</b>
	<i>Maureen M. Hanasono and Peter G. Cordeiro</i>	
<b>10</b>	<b>Local flaps for facial coverage</b>	<b>229</b>
	<i>Nicholas Do and John Brian Boyd</i>	
<b>11</b>	<b>Lip reconstruction</b>	<b>256</b>
	<i>Julian J. Ponsaz and Mitchell Buller</i>	
<b>12</b>	<b>Oral cavity, tongue, and mandibular reconstructions</b>	<b>275</b>
	<i>Ming-Huei Cheng</i>	
<b>13</b>	<b>Hypopharyngeal, esophageal, and neck reconstruction</b>	<b>302</b>
	<i>Min-Jeong Cho and Peirong Yu</i>	
<b>14</b>	<b>Secondary facial reconstruction</b>	<b>336</b>
	<i>Afaaf Shakir and Lawrence J. Gottlieb</i>	
<b>15</b>	<b>Facial paralysis</b>	<b>359</b>
	<i>Simeon C. Daeschler, Ronald M. Zuker, and Gregory H. Borschel</i>	
<b>16</b>	<b>Surgical management of facial pain, including migraines</b>	<b>390</b>
	<i>Anna Schoenbrunner and Jeffrey E. Janis</i>	
<b>17</b>	<b>Facial feminization</b>	<b>400</b>
	<i>Luis Capitán, Daniel Simon, and Fermín Capitán-Cañadas</i>	

**Part 2: Pediatric Surgery: edited by Joseph E. Losee**

<b>18 Embryology of the craniofacial complex</b>	442	<b>25.2 Nonsyndromic craniosynostosis</b>	808
<i>Jingtao Li and Jill A. Helms</i>		<i>Sameer Shakir and Jesse A. Taylor</i>	
<b>Section I: Clefts</b>		<b>25.3 Multisutural syndromic synostosis</b>	827
<b>19.1 Unilateral cleft lip: introduction</b>	451	<i>Richard A. Hopper and Benjamin B. Massenburg</i>	
<i>Joseph E. Losee and Michael R. Bykowski</i>		<b>25.4 Neurosurgical and developmental issues in craniosynostosis</b>	849
<b>19.2 Rotation advancement cheiloplasty</b>	456	<i>Alexandra Junn, John T. Smetona, Michael Alperovich, and John A. Persing</i>	
<i>Philip Kuo-Ting Chen and Lucia Pannuto</i>		<b>26 Craniofacial microsomia</b>	859
<b>19.3 Extended Mohler repair</b>	488	<i>Craig B. Birgfeld and Scott P. Bartlett</i>	
<i>Roberto L. Flores</i>		<b>27 Idiopathic progressive hemifacial atrophy</b>	887
<b>19.4 Anatomic subunit approximation approach to unilateral cleft lip repair</b>	499	<i>Peter J. Taub, Kathryn S. Torok, Daniel H. Glaser, and Lindsay A. Schuster</i>	
<i>Raymond W. Tse and David M. Fisher</i>		<b>28 Robin sequence</b>	902
<b>20 Repair of bilateral cleft lip</b>	519	<i>Sofia Aronson, Chad A. Purnell, and Arun K. Gosain</i>	
<i>John B. Mulliken and Daniel M. Balkin</i>		<b>29 Treacher Collins syndrome</b>	923
<b>21.1 Cleft palate: introduction</b>	538	<i>Irene Mathijssen</i>	
<i>Michael R. Bykowski and Joseph E. Losee</i>		<b>Section III: Pediatrics</b>	
<b>21.2 Straight line repair with intravelar veloplasty (IVVP)</b>	542	<b>30 Congenital melanocytic nevi</b>	935
<i>Brian Sommerlad</i>		<i>Sara R. Dickie, Neta Adler, and Bruce S. Bauer</i>	
<b>21.3 Double opposing Z-palatoplasty</b>	549	<b>31 Vascular anomalies</b>	952
<i>Jordan N. Halsey and Richard E. Kirschner</i>		<i>Arin K. Greene and John B. Mulliken</i>	
<b>21.4 Buccal myomucosal flap palate repair</b>	557	<b>32 Pediatric chest and trunk deformities</b>	974
<i>Robert Joseph Mann</i>		<i>Han Zhuang Beh, Andrew M. Ferry, Rami P. Dibbs, Edward P. Buchanan, and Laura A. Monson</i>	
<b>21.5 The buccal fat pad flap</b>	567	<b>33 Pediatric tumors</b>	988
<i>James D. Vargo and Steven R. Buchman</i>		<i>Matthew R. Greives, George Washington, Sahil Kapur, and Michael Bentz</i>	
<b>21.6 Oral fistula closure</b>	575	<b>34 Conjoined twins</b>	1001
<i>Mirko S. Gillardino, Sabrina Cugno, and Abdulaziz Alabdulkarim</i>		<i>Anna R. Carlson, Gregory G. Heuer, and Jesse A. Taylor</i>	
<b>21.7 Alveolar clefts</b>	583	<b>Index</b>	1011
<i>Katelyn Kondra, Eloise Stanton, Christian Jimenez, Erik M. Wolfswinkel, Stephen Yen, Mark Urata, and Jeffrey Hammoudeh</i>			
<b>21.8 Orthodontics in cleft lip and palate management</b>	592		
<i>Alvaro A. Figueroa, Alexander L. Figueroa, Gerson R. Chinchilla, and Marta Alvarado</i>			
<b>21.9 Velopharyngeal dysfunction</b>	618		
<i>Richard E. Kirschner, Hannah J. Bergman, and Adriane L. Baylis</i>			
<b>21.10 Secondary deformities of the cleft lip, nose, and palate</b>	636		
<i>Han Zhuang Beh, Rami P. Dibbs, Andrew M. Ferry, Robert F. Dempsey, Edward P. Buchanan, and Larry H. Hollier Jr.</i>			
<b>21.11 Cleft and craniofacial orthognathic surgery</b>	661		
<i>Stephen B. Baker, Brian L. Chang, and Anusha Singh</i>			
<b>Section II: Craniofacial</b>			
<b>22 Pediatric facial fractures</b>	708		
<i>John T. Smetona, Jesse A. Goldstein, Michael R. Bykowski, and Joseph E. Losee</i>			
<b>23 Orbital hypertelorism</b>	726		
<i>Eric Arnaud, Giovanna Paternoster, Roman Khonsari, Samer E. Haber, and Syril James</i>			
<b>24 Craniofacial clefts</b>	747		
<i>James P. Bradley and Henry K. Kawamoto Jr.</i>			
<b>25.1 Craniosynostosis: introduction</b>	775		
<i>Christopher R. Forrest and Johanna N. Riesel</i>			

**Volume Four: Lower Extremity, Trunk and Burns**edited by **David H. Song and Joon Pio Hong**

<b>1 Comprehensive lower extremity anatomy</b>	1
<i>Rajiv P. Bank and Grant M. Kleiber</i>	
<b>2 Management of lower extremity trauma</b>	52
<i>Hyunsuk Peter Suh</i>	
<b>Section I: Lower Extremity Surgery</b>	
<b>3.1 Lymphedema: introduction and editors' perspective</b>	76
<i>Joon Pio Hong and David H. Song</i>	
<b>3.2 Imaging modalities for diagnosis and treatment of lymphedema</b>	78
<i>Balazs Mohos and Chieh-Han John Tzou</i>	
<b>3.3 Lymphaticovenular bypass</b>	92
<i>Wei F. Chen, Lynn M. Orfahli, and Vahe Fahradyan</i>	
<b>3.4 Vascularized lymph node transplant</b>	102
<i>Rebecca M. Garza and David W. Chang</i>	
<b>3.5 Debulking strategies and procedures: liposuction of leg lymphedema</b>	111
<i>Håkan Brorson</i>	
<b>3.6 Debulking strategies and procedures: excision</b>	120
<i>Hung-Chi Chen and Yueh-Bih Tang</i>	

<b>4 Lower extremity sarcoma reconstruction</b>	128	<b>15 Reconstruction of acquired vaginal defects</b>	452
<i>Andrés A. Maldonado, Günter K. Germann, and Michael Sauerbier</i>		<i>Leila Jazayeri, Andrea L. Pusic, and Peter G. Cordeiro</i>	
<b>5 Reconstructive surgery: lower extremity coverage</b>	154	<b>16 Pressure sores</b>	462
<i>Joon Pio Hong</i>		<i>Ibrahim Khansa and Jeffrey E. Janis</i>	
<b>6.1 Diagnosis, treatment, and prevention of lower extremity pain</b>	180	<b>17 Perineal reconstruction</b>	489
<i>Brian L. Chang and Grant M. Kleiber</i>		<i>Ping Song, Hakim Said, and Otway Louie</i>	
<b>6.2 Targeted muscle reinnervation in the lower extremity</b>	190	<b>Section III: Burn Surgery</b>	
<i>Brian L. Chang and Grant M. Kleiber</i>		<b>18 Burn, chemical, and electrical injuries</b>	501
<b>6.3 Lower extremity pain: regenerative peripheral nerve interfaces</b>	203	<i>Raphael C. Lee and Chad M. Teven</i>	
<i>Nishant Ganesh Kumar, Theodore A. King, and Paul S. Cederna</i>		<b>19 Extremity burn reconstruction</b>	538
<b>7 Skeletal reconstruction</b>	210	<i>S. Raja Sabapathy, R. Raja Shanmugakrishnan, and Vamseedharan Muthukumar</i>	
<i>Marco Innocenti, Stephen Kovach III, Elena Lucattelli, and L. Scott Levin</i>		<b>20 Management of the burned face and neck</b>	561
<b>8 Foot reconstruction</b>	228	<i>Vinita Puri and Venkateshwaran Narasiman</i>	
<i>Romina Deldar, Zoe K. Haffner, Adaah A. Sayad, John S. Steinberg, Karen K. Evans, and Christopher E. Attinger</i>		<b>21 Pediatric burns</b>	589
<b>9.1 Diabetic foot: introduction</b>	265	<i>Sebastian Q. Vrouwe and Lawrence J. Gottlieb</i>	
<i>Kevin G. Kim, Paige K. Dekker, John D. Miller, Jayson N. Atves, John S. Steinberg, and Karen K. Evans</i>		<i>Index</i>	610
<b>9.2 Diabetic foot: management of wounds and considerations in biomechanics and amputations</b>	270		
<i>Jayson N. Atves, John D. Miller, and John S. Steinberg</i>			
<b>9.3 Diabetic foot: management of vascularity and considerations in soft-tissue reconstruction</b>	296		
<i>Paige K. Dekker, Kevin G. Kim, and Karen K. Evans</i>			
<b>Section II: Trunk, Perineum, and Transgender</b>			
<b>10 Trunk anatomy</b>	311		
<i>J. Andres Hernandez, Andrew Nagy Atia, and Scott Thomas Hollenbeck</i>			
<b>11 Reconstruction of the chest</b>	327		
<i>Brian L. Chang, Banafsheh Sharif-Askary, and David H. Song</i>			
<b>12 Reconstruction of the posterior trunk</b>	354		
<i>Reuben A. Falola, Nicholas F. Lombana, Andrew M. Altman, and Michel H. Saint-Cyr</i>			
<b>13 Abdominal wall reconstruction</b>	388		
<i>Gregory A. Dumanian</i>			
<b>14.1 Gender confirmation surgery: diagnosis and management</b>	407		
<i>Loren Schechter and Rayisa Hontscharuk</i>			
<b>14.2 Gender confirmation surgery, male to female: vaginoplasty</b>	414		
<i>Loren Schechter and Rayisa Hontscharuk</i>			
<b>14.3 Gender affirmation surgery, female to male: phalloplasty; and correction of male genital defects</b>	421		
<i>Alexander Y. Li, Walter C. Lin, and Bauback Safa</i>			
<b>14.4 Breast, chest wall, and facial considerations in gender affirmation</b>	439		
<i>Kaylee B. Scott, Dana N. Johns, and Cori A. Agarwal</i>			
		<b>Volume Five: Breast</b>	
		<i>edited by Maurice Y. Nahabedian</i>	
		<b>Section I: Aesthetic Breast Surgery</b>	
		<b>1 Preoperative assessment and planning of the aesthetic breast patient</b>	1
		<i>Kiya Movassaghi and Christopher N. Stewart</i>	
		<b>2 Current status of breast implants</b>	13
		<i>Patrick Mallucci and Giovanni Bistoni</i>	
		<b>3 Primary breast augmentation with implants</b>	28
		<i>Charles Randquist</i>	
		<b>4 Autologous fat transfer: fundamental principles and application for breast augmentation</b>	52
		<i>Fogor Khalil Khouri, Raul A. Cortes, and Daniel Calva-Cerquiera</i>	
		<b>5 Augmentation mastopexy</b>	69
		<i>Justin L. Perez, Daniel J. Gould, Michelle Spring, and Grant Stevens</i>	
		<b>6 Mastopexy after massive weight loss</b>	83
		<i>Francesco M. Egro and J. Peter Rubin</i>	
		<b>7 Prevention and management of complications following breast augmentation and mastopexy</b>	92
		<i>M. Bradley Calobrace and Chester J. Mays</i>	
		<b>8 Short scar breast reduction</b>	102
		<i>Elizabeth Hall-Findlay, Elisa Bolletta, and Gustavo Jiménez Muñoz Ledo</i>	
		<b>9 Reduction mammoplasty with inverted-T techniques</b>	131
		<i>Maurice Y. Nahabedian</i>	
		<b>10 Breast implant illness: diagnosis and management</b>	154
		<i>Caroline A. Glicksman and Patricia McGuire</i>	
		<b>11 Breast implant-associated anaplastic large cell lymphoma (BIA-ALCL): diagnosis and management</b>	160
		<i>Mark W. Clemens, Eliora A. Tesfaye, and Anand Deva</i>	

<b>12</b>	<b>A critical analysis of irrigation solutions in breast surgery</b>	<b>174</b>	<b>29</b>	<b>Breast reconstruction with the latissimus dorsi flap</b>	<b>355</b>
	<i>Grace Keane, Marissa M. Tenenbaum, and Terence M. Myckatyn</i>			<i>Dennis C. Hammond</i>	
<b>13</b>	<b>Imaging and surveillance in patients with breast implants</b>	<b>182</b>	<b>30</b>	<b>Autologous breast reconstruction with the DIEP flap</b>	<b>371</b>
	<i>Bradley Bengtson, Patricia McGuire, Caroline Glicksman, and Pat Pazmiño</i>			<i>Adrian McArdle and Joan E. Lipa</i>	
<b>14</b>	<b>Breast implant explantation: indications and strategies to optimize aesthetic outcomes</b>	<b>191</b>	<b>31</b>	<b>Autologous breast reconstruction with the free TRAM flap</b>	<b>396</b>
	<i>Connor Crowley, M. Bradley Calobrace, Mark W. Clemens, and Neil Tanna</i>			<i>Jin Sup Eom and Hyunho Han</i>	
<b>15</b>	<b>Management strategies for gynecomastia</b>	<b>200</b>	<b>32</b>	<b>Autologous breast reconstruction with the superficial inferior epigastric artery (SIEA) flap</b>	<b>413</b>
	<i>Michele Ann Manahan</i>			<i>Pierre Chevray</i>	
<b>16</b>	<b>Management options for gender affirmation surgery of the breast</b>	<b>207</b>	<b>33</b>	<b>Introduction to autologous reconstruction with alternative free flaps</b>	<b>420</b>
	<i>Ara A. Salibian, Gaines Blasdel, and Rachel Bluebond-Langner</i>			<i>Maurice Y. Nahabedian</i>	
<b>Section II: Reconstructive Breast Surgery</b>			<b>34</b>	<b>Gluteal free flaps for breast reconstruction</b>	<b>424</b>
<b>17</b>	<b>Preoperative evaluation and planning for breast reconstruction following mastectomy</b>	<b>222</b>		<i>Salih Colakoglu and Gedge D. Rosson</i>	
	<i>Said C. Azoury and Liza C. Wu</i>		<b>35</b>	<b>Autologous breast reconstruction with medial thigh flaps</b>	<b>433</b>
<b>18</b>	<b>Perfusion assessment techniques following mastectomy and reconstruction</b>	<b>234</b>		<i>Venkat V. Ramakrishnan and Nakul Gamanlal Patel</i>	
	<i>Alex Mesbahi, Matthew Cissell, Mark Venturi, and Louisa Yemc</i>		<b>36</b>	<b>Autologous breast reconstruction with the profunda artery perforator (PAP) flap</b>	<b>450</b>
<b>19</b>	<b>Introduction to prosthetic breast reconstruction</b>	<b>239</b>		<i>Adam T. Hauch, Hugo St. Hilaire, and Robert J. Allen, Sr.</i>	
	<i>Maurice Y. Nahabedian</i>		<b>37</b>	<b>Autologous reconstruction with the lumbar artery perforator (LAP) free flap</b>	<b>461</b>
<b>20</b>	<b>One- and two-stage prepectoral reconstruction with prosthetic devices</b>	<b>247</b>		<i>Phillip Blondeel and Dries Opsomer</i>	
	<i>Alberto Rancati, Claudio Angrigiani, Maurizio Nava, Dinesh Thekkinkattil, Raghavan Vidya, Marcelo Irigo, Agustin Rancati, Allen Gabriel, and Patrick Maxwell</i>		<b>38</b>	<b>Hybrid breast reconstruction: combining flaps and implants</b>	<b>468</b>
<b>21</b>	<b>One-stage dual-plane reconstruction with prosthetic devices</b>	<b>265</b>		<i>Arash Momeni, Hani Sbitany, and Suhail K. Kanchwala</i>	
	<i>Brittany L. Vieira and Amy S. Colwell</i>		<b>39</b>	<b>Innervation of autologous flaps</b>	<b>475</b>
<b>22</b>	<b>Two-stage dual-plane reconstruction with prosthetic devices</b>	<b>280</b>		<i>Aldona J. Spiegel and Janak A. Parikh</i>	
	<i>Ara A. Salibian and Nolan S. Karp</i>		<b>40</b>	<b>Stacked and conjoined flaps</b>	<b>481</b>
<b>23</b>	<b>Two-stage prosthetic reconstruction with total muscle coverage</b>	<b>293</b>		<i>Nicholas T. Haddock and Sumeet S. Teotia</i>	
	<i>Colleen M. McCarthy and Peter G. Cordeiro</i>		<b>41</b>	<b>Management of complications following autologous breast reconstruction</b>	<b>488</b>
<b>24</b>	<b>Skin reduction using “smile mastopexy” technique in breast reconstruction</b>	<b>298</b>		<i>Anne C. O’Neill, Vincent J. Choi, and Stefan O.P. Hofer</i>	
	<i>Kiya Movassaghi and Christopher N. Stewart</i>		<b>42</b>	<b>Enhanced recovery after surgery (ERAS) protocols in breast surgery: techniques and outcomes</b>	<b>498</b>
<b>25</b>	<b>Management of complications of prosthetic breast reconstruction</b>	<b>304</b>		<i>Nicholas F. Lombana, Reuben A. Falola, John C. Cargile, and Michel H. Saint-Cyr</i>	
	<i>Nima Khavanin and John Y.S. Kim</i>		<b>43</b>	<b>Secondary procedures following autologous reconstruction</b>	<b>516</b>
<b>26</b>	<b>Secondary refinement procedures following prosthetic breast reconstruction</b>	<b>317</b>		<i>Jian Farhadi and Vendela Grufman</i>	
	<i>Roy de Vita and Veronica Vietti Michelina</i>		<b>44</b>	<b>Introduction to oncoplastic breast surgery</b>	<b>526</b>
<b>27</b>	<b>Introduction to autologous breast reconstruction with abdominal free flaps</b>	<b>336</b>		<i>Maurice Y. Nahabedian</i>	
	<i>Maurice Y. Nahabedian</i>		<b>45</b>	<b>Partial breast reconstruction using reduction and mastopexy techniques</b>	<b>533</b>
<b>28</b>	<b>Breast reconstruction with the pedicle TRAM flap</b>	<b>340</b>		<i>Albert Losken, Nusaiba F. Baker, and Alexandre Munhoz</i>	
	<i>Jake C. Laun and Julian J. Pribaz</i>		<b>46</b>	<b>Oncoplastic breast reconstruction: local flap techniques</b>	<b>547</b>
				<i>Moustapha Hamdi and Claudio Angrigiani</i>	
			<b>47</b>	<b>Surgical and non-surgical management of breast cancer-related lymphedema</b>	<b>556</b>
				<i>Ketan M. Patel, Emma C. Koesters, Rachel Lentz, and Orr Shaully</i>	

<b>48</b>	<b>Breast reconstruction and radiotherapy: indications, techniques, and outcomes</b>	<b>567</b>			
	<i>Jaume Maslà, Crishtian D. Pomata, and Javier Sanz</i>				
<b>49</b>	<b>Robotic-assisted autologous breast reconstruction</b>	<b>581</b>			
	<i>Karim A. Sarhane and Jesse C. Selber</i>				
<b>50</b>	<b>Total breast reconstruction by external vacuum expansion (EVE) and autologous fat transfer (AFT)</b>	<b>590</b>			
	<i>Andrzej Piatkowski and Roger K. Khouri</i>				
<b>51</b>	<b>Current options for nipple reconstruction</b>	<b>603</b>			
	<i>David Chi and Justin M. Sacks</i>				
	<i>Index</i>	<b>610</b>			
<b>Volume Six: Hand and Upper Extremity</b>					
	<b>Introduction: Plastic surgery contributions to hand surgery</b>		<b>liii</b>		
	<i>James Chang</i>				
	<b>Section I: Principles of Hand Surgery</b>				
<b>1</b>	<b>Anatomy and biomechanics of the hand</b>	<b>1</b>			
	<i>James Chang, Anais Legrand, Francisco J. Valero-Cuevas, Vincent R. Hentz, and Robert A. Chase</i>				
<b>2</b>	<b>Examination of the upper extremity</b>	<b>49</b>			
	<i>Ryosuke Kakinoki</i>				
<b>3</b>	<b>Diagnostic imaging of the hand and wrist</b>	<b>70</b>			
	<i>Alphonsus K.S. Chong, Janice Liao, and David M.K. Tan</i>				
<b>4</b>	<b>Anesthesia for upper extremity surgery</b>	<b>95</b>			
	<i>Eugene Park, Jonay Hill, Vanila M. Singh, and Subhro K. Sen</i>				
<b>5</b>	<b>Principles of internal fixation</b>	<b>109</b>			
	<i>Margaret Fok, Jason R. Kang, Christopher Cox, and Jeffrey Yao</i>				
	<b>Section II: Trauma Reconstruction</b>				
<b>6</b>	<b>Nail and fingertip reconstruction</b>	<b>123</b>			
	<i>Amanda Brown, Brian A. Mailey, and Michael W. Neumeister</i>				
<b>7</b>	<b>Hand fractures and joint injuries</b>	<b>147</b>			
	<i>Warren C. Hammert and Randy R. Bindra</i>				
<b>8</b>	<b>Fractures and dislocations of the wrist and distal radius</b>	<b>173</b>			
	<i>Steven C. Haase and Kevin C. Chung</i>				
<b>9</b>	<b>Flexor tendon injuries and reconstruction</b>	<b>193</b>			
	<i>Jin Bo Tang</i>				
<b>10</b>	<b>Extensor tendon injuries</b>	<b>230</b>			
	<i>Kai Megerle and Karl-Josef Prommersberger</i>				
<b>11</b>	<b>Replantation</b>	<b>250</b>			
	<i>Dong Chul Lee and Eugene Park</i>				
<b>12</b>	<b>Reconstructive surgery of the mutilated hand</b>	<b>272</b>			
	<i>S. Raja Sabapathy and Hari Venkatraman</i>				
<b>13</b>	<b>Thumb reconstruction: Non-microsurgical techniques</b>	<b>305</b>			
	<i>Jeffrey B. Friedrich, Nicholas B. Vedder, and Elisabeth Haas-Lützenberger</i>				
<b>14</b>	<b>Thumb reconstruction: Microsurgical techniques</b>	<b>320</b>			
	<i>Nidal F. Al Deek and Fu-Chan Wei</i>				
	<b>Section III: Specific Disorders</b>				
<b>15</b>	<b>Infections of the hand</b>	<b>337</b>			
	<i>Andrew O'Brien, Ryan P. Calfee, Jana Dengler, and Amy M. Moore</i>				
<b>16</b>	<b>Tumors of the hand</b>	<b>356</b>			
	<i>Kashyap K. Tadisina, Justin M. Sacks, and Mitchell A. Pet</i>				
<b>17</b>	<b>Dupuytren's disease</b>	<b>384</b>			
	<i>James K-K. Chan, Paul M.N. Werker, and Jagdeep Nanchahal</i>				
<b>18</b>	<b>Osteoarthritis in the hand and wrist</b>	<b>411</b>			
	<i>Paige M. Fox, J. Henk Coert, and Steven L. Moran</i>				
<b>19</b>	<b>Rheumatologic conditions of the hand and wrist</b>	<b>449</b>			
	<i>Douglas M. Sammer and Kevin C. Chung</i>				
<b>20</b>	<b>Occupational disorders of the hand</b>	<b>491</b>			
	<i>Celine Yeung and Steven J. McCabe</i>				
	<b>Section IV: Nerve Disorders</b>				
<b>21</b>	<b>Nerve entrapment syndromes</b>	<b>499</b>			
	<i>Elisabet Hagert and Donald Lalonde</i>				
<b>22</b>	<b>Peripheral nerve repair and reconstruction</b>	<b>526</b>			
	<i>Simon Farnebo, Johan Thorfinn, and Lars B. Dahlin</i>				
<b>23</b>	<b>Brachial plexus injuries: adult and pediatric</b>	<b>552</b>			
	<i>Johnny Chuieng-Yi Lu and David Chwei-Chin Chuang</i>				
<b>24</b>	<b>Tetraplegia</b>	<b>585</b>			
	<i>Carina Reinholdt and Catherine Curtin</i>				
<b>25</b>	<b>Tendon transfers</b>	<b>605</b>			
	<i>Neil F. Jones</i>				
<b>26</b>	<b>Nerve transfers</b>	<b>638</b>			
	<i>Kirsty Usher Boyd, Ida K. Fox, and Susan E. Mackinnon</i>				
<b>27</b>	<b>Free-functioning muscle transfer</b>	<b>665</b>			
	<i>Siméon C. Daeschler, Kristen M. Davidge, Julia Harhaus, and Gregory H. Borschel</i>				
	<b>Section V: Challenging Disorders</b>				
<b>28</b>	<b>The ischemic hand</b>	<b>680</b>			
	<i>Hee-Shang Ahn, Jung Soo Yoon, and Neil F. Jones</i>				
<b>29</b>	<b>The spastic hand</b>	<b>704</b>			
	<i>Caroline Leclercq, Nathalie Bini, and Charlotte Jaloux</i>				
<b>30</b>	<b>The stiff hand</b>	<b>716</b>			
	<i>David T. Netscher, Rita E. Baumgartner, Kimberly Goldie Staines, and Logan W. Carr</i>				
<b>31</b>	<b>The painful hand</b>	<b>735</b>			
	<i>Hazel Brown, Anna Berridge, Dennis Hazell, Parashar Ramanuj, and Tom J. Quick</i>				
	<b>Section VI: Congenital Disorders</b>				
<b>32</b>	<b>Congenital hand I: Embryology, classification, and principles</b>	<b>746</b>			
	<i>Michael Tonkin and Kerby C. Oberg</i>				
<b>33</b>	<b>Congenital hand II: Malformations – whole limb</b>	<b>770</b>			
	<i>Aaron Berger, Soumen Das De, Bhaskaranand Kumar, and Pundrique Sharma</i>				
<b>34</b>	<b>Congenital hand III: Malformations – abnormal axis differentiation – hand plate: proximodistal and radioulnar</b>	<b>790</b>			
	<i>Brinkley K. Sandvall and Charles A. Goldfarb</i>				

<b>35</b>	<b>Congenital hand IV: Malformations – abnormal axis differentiation – hand plate: unspecified axis</b>	<b>824</b>		
	<i>Christianne A. van Nieuwenhoven</i>			
<b>36</b>	<b>Congenital hand V: Deformations and dysplasias – variant growth</b>	<b>842</b>		
	<i>Wee Leon Lam, Xiaofei Tian, Gillian D. Smith, and Shanlin Chen</i>			
<b>37</b>	<b>Congenital hand VI: Dysplasias – tumorous conditions</b>	<b>868</b>		
	<i>Amir H. Taghinia and Joseph Upton</i>			
<b>38</b>	<b>Congenital hand VII: Dysplasias – congenital contractures</b>	<b>898</b>		
	<i>Ellen Satteson, Paul C. Dell, Xiao Fang Shen, and Harvey Chim</i>			
<b>39</b>	<b>Growth considerations in the pediatric upper extremity</b>	<b>909</b>		
	<i>Marco Innocenti and Sara Calabrese</i>			
			<b>Section VII: New Directions</b>	
			<b>40</b>	<b>Treatment of the upper extremity amputee</b> <b>930</b>
				<i>Gregory Ara Dumanian, Sumanas W. Jordan, and Jason Hyunsuk Ko</i>
			<b>41</b>	<b>Upper extremity composite allotransplantation</b> <b>949</b>
				<i>Christopher D. Lopez, Joseph Lopez, Jaimie T. Shores, W.P. Andrew Lee, and Gerald Brandacher</i>
			<b>42</b>	<b>Aesthetic hand surgery</b> <b>963</b>
				<i>David Alan Kulber and Meghan C. McCullough</i>
			<b>43</b>	<b>Hand therapy</b> <b>983</b>
				<i>Wendy Moore, Minnie Mau, and Brittany N. Garcia</i>
			<i>Index</i>	<b>999</b>

[www.abadisteb.pub](http://www.abadisteb.pub)



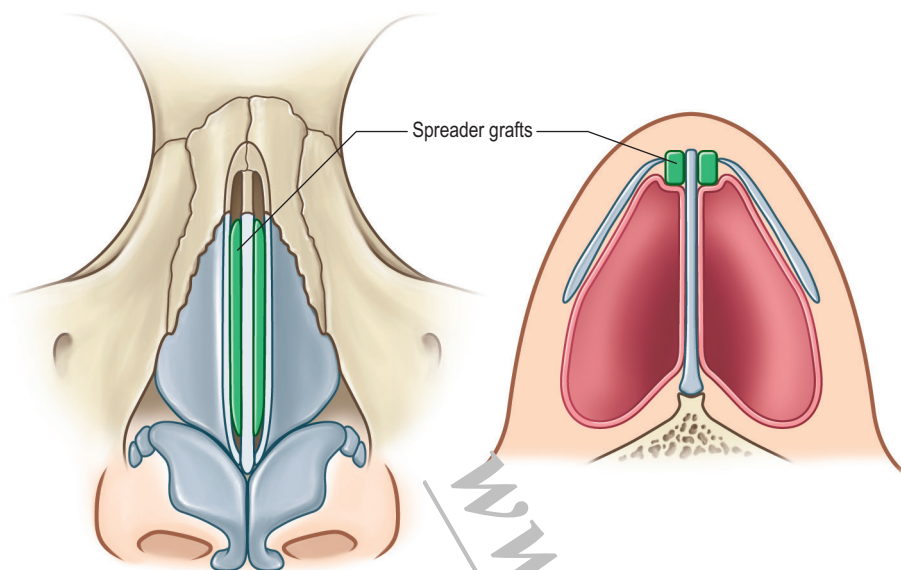


Figure 19.6 Dorsal spreader grafts.

#### BOX 19.5 Classification of nasal deviations

- I. Caudal septal deviation
  - a. Straight septal tilt
  - b. Concave deformity (C-shaped)
  - c. S-shaped deformity
- II. Concave dorsal deformity
  - a. C-shaped dorsal deformity
  - b. Reverse C-shaped dorsal deformity
- III. Concave/convex dorsal deformity (S-shaped)

present. Correction of septal deviation is key to improving nasal airflow and correcting the deviated nose.

The following principles are used to correct nasal deviation and perform septal reconstruction: (1) exposure of all deviated structures through the open approach; (2) release of all mucoperichondrial attachments to the septum, especially the deviated part; (3) straightening of the septum, and if necessary septal reconstruction, while maintaining a 10mm or wider caudal and dorsal L-strut; (4) correction of any caudal septal deviation after the posterior septum has been reconstructed; (5) correction of dorsal septal deviations with cartilage grafting and/or scoring techniques; (6) restoration of long-term support with buttressing caudal septal batten or dorsal nasal spreader grafts; (7) if necessary, submucous resection of hypertrophied inferior turbinates; and (8) precisely planned and executed external percutaneous osteotomies.<sup>43-45</sup>

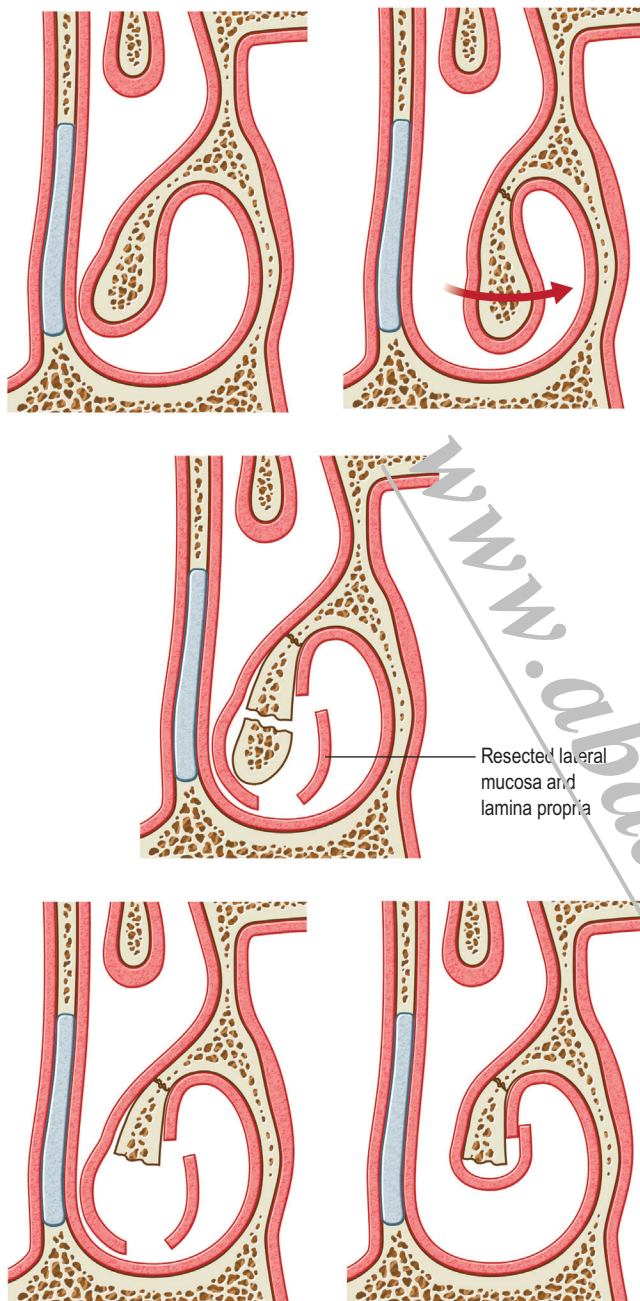
As opposed to septoplasty, where the septal cartilage is scored in an attempt to straighten it, or submucosal resection, where the majority of the septum is removed other than the L-strut, septal reconstruction differs in that only the portion of the septum causing airway obstruction is removed, with the idea that native cartilage is preserved. It is of critical importance to preserve an L-strut of septal cartilage for structural integrity. The technique for septal reconstruction is similar to that for septal cartilage harvest and is discussed later in this chapter.

#### Inferior outfracture/limited submucous resection

The turbinates exist as three or four bilateral extensions from the lateral nasal cavity. The inferior turbinate consists of highly vascular mucoperiosteum covering a thin semicircular conchal bone.<sup>47</sup> It is involved in regulation of filtration and humidification of inspired air. In combination with the internal nasal valve, the anterior extent of the inferior turbinate can be responsible for up to two-thirds of the upper airway resistance.<sup>17,48</sup> Posteriorly, the inferior turbinate diverges away from the nasal septum, allowing for reduced upper airway resistance in this area.<sup>17,49</sup>

Inferior turbinoplasty is performed in patients with nasal airway obstruction secondary to inferior turbinate hypertrophy that is refractory to medical management. We prefer a more conservative surgical approach to correct inferior turbinate hypertrophy, as we have found it to be effective with low morbidity.<sup>50</sup> Overly aggressive surgical management may be complicated by bleeding, mucosal crusting and desiccation, ciliary dysfunction, chronic infection, malodorous nasal drainage, or atrophic rhinitis.<sup>17</sup> In most cases, inferior turbinoplasty with outfracture of the inferior turbinate and, in some cases, limited submucous resection, is adequate to achieve significant improvement (Fig. 19.7).<sup>50</sup>

After removal of the previously placed oxymetazoline-soaked cottonoid pledgets, the inferior turbinates are inspected after vasoconstriction of the overlying mucosa has occurred. In cases of inferior turbinate mucosal hypertrophy, a long Vienna speculum is used to outfracture the inferior turbinates.<sup>50</sup> In cases of inferior turbinate bony hypertrophy, limited submucous resection of the inferior turbinate is indicated.<sup>50</sup> Outfracture is performed so that the entire inferior turbinate is microfractured laterally to open the nasal cavity. Limited submucous resection is performed using needle point electrocautery to incise the inferior border of the anterior 1-2cm of the inferior turbinate down to the conchal bone. A Cottle elevator is used to develop a medially based submucoperichondrial flap to expose the portion of the conchal bone to be resected. Takahashi forceps are used to sharply resect the bone from the anterior third of the turbinate. The mucoperichondrial flap is replaced down over the cut edge of the



**Figure 19.7** Inferior turbinate outfracture and submucosal resection.

conchal bone; no suturing is necessary as this will adhere to the raw surface. Replacement of the flap will avoid postoperative hemorrhage or crusting. 🌐

## The nasal tip

A graduated approach to nasal tip surgery requires a combination of techniques including the cephalic trim, the use of a columellar strut graft, nasal tip suturing, and nasal tip grafting. Application of these techniques will help to correct tip deformities and improve tip shape while minimizing deformities secondary to loss of support. In addition, compared with the closed approach, the open approach may cause mild loss

of tip projection due to disruption of ligamentous support and increased skin undermining.<sup>67</sup> As such, we commonly employ columellar strut graft and nasal tip suturing techniques to maintain nasal tip support during open rhinoplasty.

### Cephalic trim

Cephalic trim is commonly performed with the bulbous or boxy tip (Fig. 19.14).<sup>68</sup> Paradomal fullness is secondary to prominence of the cephalic border of the middle and lateral crura of the lower lateral cartilages. Cephalic trim of this area reduces paradomal fullness and helps to define the tip and narrow the distance between the tip-defining points. An alar rim strip of at least 5–6 mm is preserved for adequate support of the external valve. Cephalic trim should be used judiciously. In some cases in which the quality of the lower lateral cartilages is poor, cephalic trim will further weaken the cartilages despite preserving a 5–6 mm alar rim strip, leading to alar rim collapse. In these cases, use of a lower lateral crural turnover flap is a better option to improve tip definition while preserving structural support.<sup>69</sup> Calipers should be used to accurately measure the alar rim strip. The excised cartilage can also be used as a source of autogenous grafts.

A lower lateral crural turnover flap is another useful technique to address paradomal fullness while providing additional support to the lower lateral cartilages.<sup>69</sup> It is beneficial for deformities, weakness, and collapse of the lower lateral crura and can also be used to improve lower lateral crural strength during tip reshaping. However, there must be sufficient lower lateral crura to leave a 5 mm alar rim strip. It can be used in combination with other external valve and alar rim supporting techniques.

### Columellar strut graft

An intercrustral columellar strut graft is used to maintain or increase nasal tip projection and aids in unifying the nasal tip.<sup>70–72</sup> It can be either floating or fixed (Fig. 19.15). A floating columellar strut graft is used more commonly to maintain tip projection and is positioned between the medial crura and rests in the soft tissues 2–3 mm anterior to the anterior nasal spine. A fixed columellar strut graft is used to increase tip projection and is positioned between the medial crura and rests on the maxilla. The columellar strut graft is typically fashioned from septal cartilage to measure 3×25 mm. A double hook is placed with a hook in the vestibular apex of each lower lateral cartilage. Upward traction is placed, and scissors are used to dissect a pocket between the medial crura down towards the anterior nasal spine. A 2–3-mm pad of soft tissue is preserved over the nasal spine to keep the graft from moving back and forth over the nasal spine with lip movements.<sup>73</sup> The columellar strut graft is placed in the pocket. With the tip-defining points held at the same level, a 5-0 PDS suture is used to stabilize the medial crura to the columellar strut graft, followed by several additional 5-0 PDS sutures to unify the nasal tip complex. The columellar strut graft is then trimmed as necessary.

### Septal extension grafts

The septal extension graft is a versatile graft that effectively controls tip projection and rotation, whereas a columellar strut

## Harvesting autologous grafting material

The trend over recent decades in rhinoplasty has shifted away from ablative techniques involving over-reducing the osseocartilaginous framework to conserving the native anatomy and augmentation of deficient areas to correct contour deformities and restore structural support. As such, certain situations require harvest of autologous cartilage for graft material. Autologous grafts are preferential to homografts and alloplastic implants because of their high biocompatibility and low risk of infection and extrusion.<sup>51</sup> Their disadvantages include donor site morbidity, graft resorption, and unavailability of sufficient quantities for graft material.<sup>41</sup> Autologous cartilage grafts are most commonly obtained from septal, ear, and costal cartilage. Other donor sites for autologous grafts include calvarial and nasal bone, and the olecranon process of the ulna.<sup>51</sup> Concerns regarding donor site morbidity, graft availability, and graft resorption will necessitate the use of homologous or alloplastic implants.<sup>52</sup> Recently, temporal fascia grafts have found utility as an autologous graft material in rhinoplasty for camouflage or as composite grafts such as diced cartilage grafts wrapped in temporal fascia. Temporal fascia can be harvested with minimal donor site morbidity and an inconspicuous scar located in the temporal scalp.<sup>53–55</sup>

### Septal cartilage

Septal cartilage is the primary choice for autogenous grafts in rhinoplasty. It can be used in all areas including tip grafts, dorsal onlay grafts, columellar strut grafts, and nasal spreader grafts.<sup>53</sup> It is easily harvested, leaves minimal donor site morbidity, and is available in the operative field. Septal cartilage harvest is performed as previously described for septal reconstruction.

Open rhinoplasty allows for ease of septal cartilage harvest with improved exposure and visualization. Septal cartilage

harvest is performed only after component dorsal hump reduction is complete as it is essential to preserve an L-strut that is at least 10mm for nasal support. However, this width will depend on the strength of the septal cartilage, and in many instances a width of 15mm or more may be required to ensure long-term support. Dorsal reduction of the septum after septal cartilage harvest may leave an L-strut that is too narrow to provide adequate nasal support. Septal cartilage harvest is performed after the lower and upper lateral cartilages have been separated from the quadrangular cartilage. A No. 15 blade scalpel is used to score the mucoperichondrium of the septal angle, and then a Cottle elevator is used to develop the submucoperichondrial pocket on both sides of the septum (Fig. 19.8). Once in the correct plane, the denuded septal cartilage has a gray–blue hue, the septal cartilage has a gritty texture, and there should be little resistance elevating the mucoperichondrium off of the septal cartilage until the dissection reaches the osseocartilaginous junction between the quadrangular cartilage and the vomer. Dissection of the submucoperichondrial pocket is done towards the floor of the nasal cavity to the maxillary crest and posteriorly to the vomer (Fig. 19.9). During development of the submucoperichondrial pockets, care is taken to avoid perforations of the mucosa. Unilateral mucosal perforations generally do not cause any problems. However, bilateral opposing mucosal perforations should be repaired with 5-0 chromic gut sutures to prevent formation of a septal perforation postoperatively. A dorsal and caudal L-strut is created using a No. 15 blade scalpel to incise the septal cartilage parallel to the dorsal edge of the septum from the perpendicular plate of the ethmoid and is curved to parallel the caudal edge of the septum (Fig. 19.10). This incision is then continued posteriorly and parallel to the caudal edge of the septum until the crest of the maxilla. A Cottle elevator is then used to elevate the septal cartilage from the maxillary crest and vomer, liberating the septal cartilage. Any dorsal or septal deviation of the perpendicular plate of the

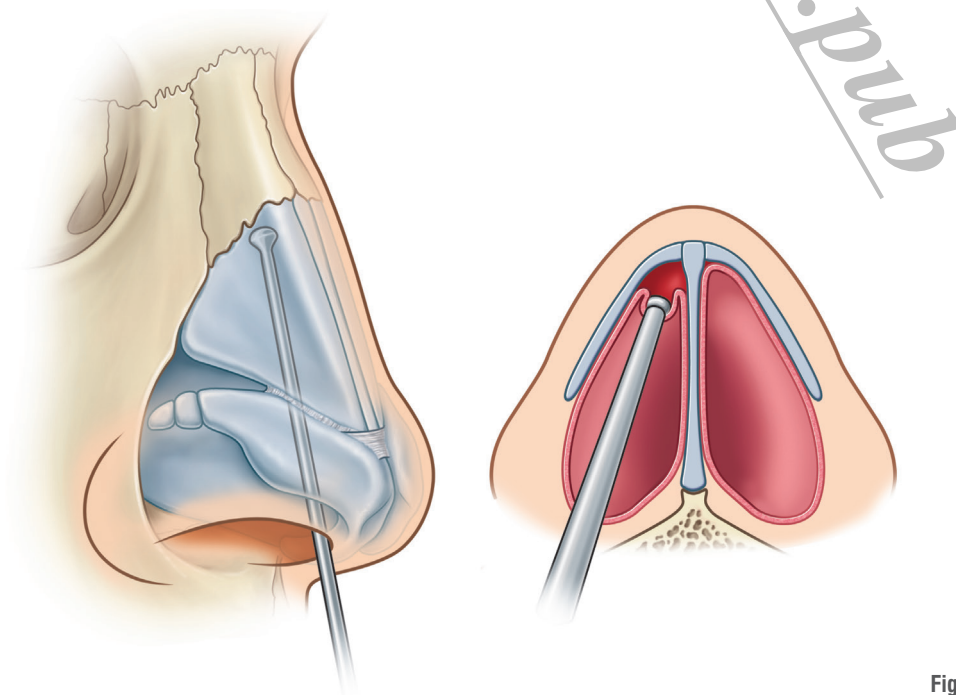


Figure 19.8 Submucoperichondrial dissection.

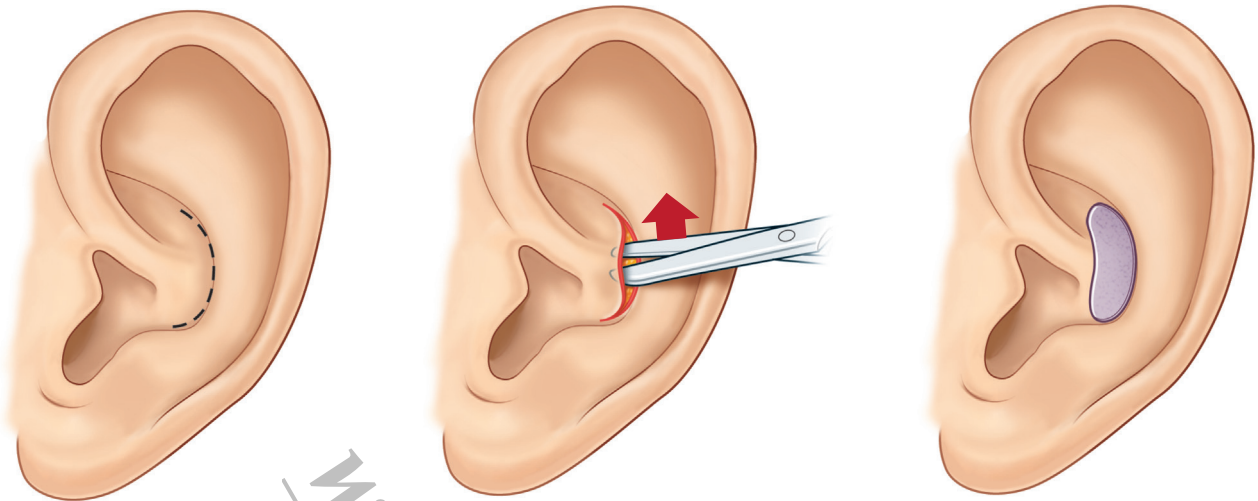


Figure 19.11 Harvesting ear cartilage.

inferiorly at the incisura intertragica, preventing donor site deformity. The outlined ear cartilage is then incised using a No. 15 blade scalpel, and fine dissecting scissors are again used to dissect the anterior auricular skin off of the anterior aspect of the conchal cartilage in the subperichondrial plane. Once the desired amount of cartilage has been dissected away from the anterior and posterior auricular skin, it is excised with a No. 15 blade scalpel. Hemostasis is obtained and the incision is closed with a 5-0 plain gut running suture, followed by placement of a tie-over petroleum gauze bolster as previously described.

### Costal cartilage

Costal cartilage provides abundant autogenous graft material. It can be used for tip grafts, columellar strut grafts, nasal spreader grafts, alar cartilage grafts, and dorsal onlay grafts. Given the size, amount, and intrinsic qualities, costal cartilage lends itself well to use as a dorsal onlay graft and where structural support is required. It can be carved into any shape. However, allowing at least 30 minutes to pass prior to carving allows initial warping to occur, minimizing late deformity.<sup>60</sup> In addition, utilizing centrally over peripherally located cartilage may help to minimize late deformity.<sup>60,61</sup> Some authors advocate the use of internal stabilization of costal cartilage grafts with Kirschner wire to prevent warping, but this can be associated with long-term complications, including extrusion of the Kirschner wire.<sup>62</sup>

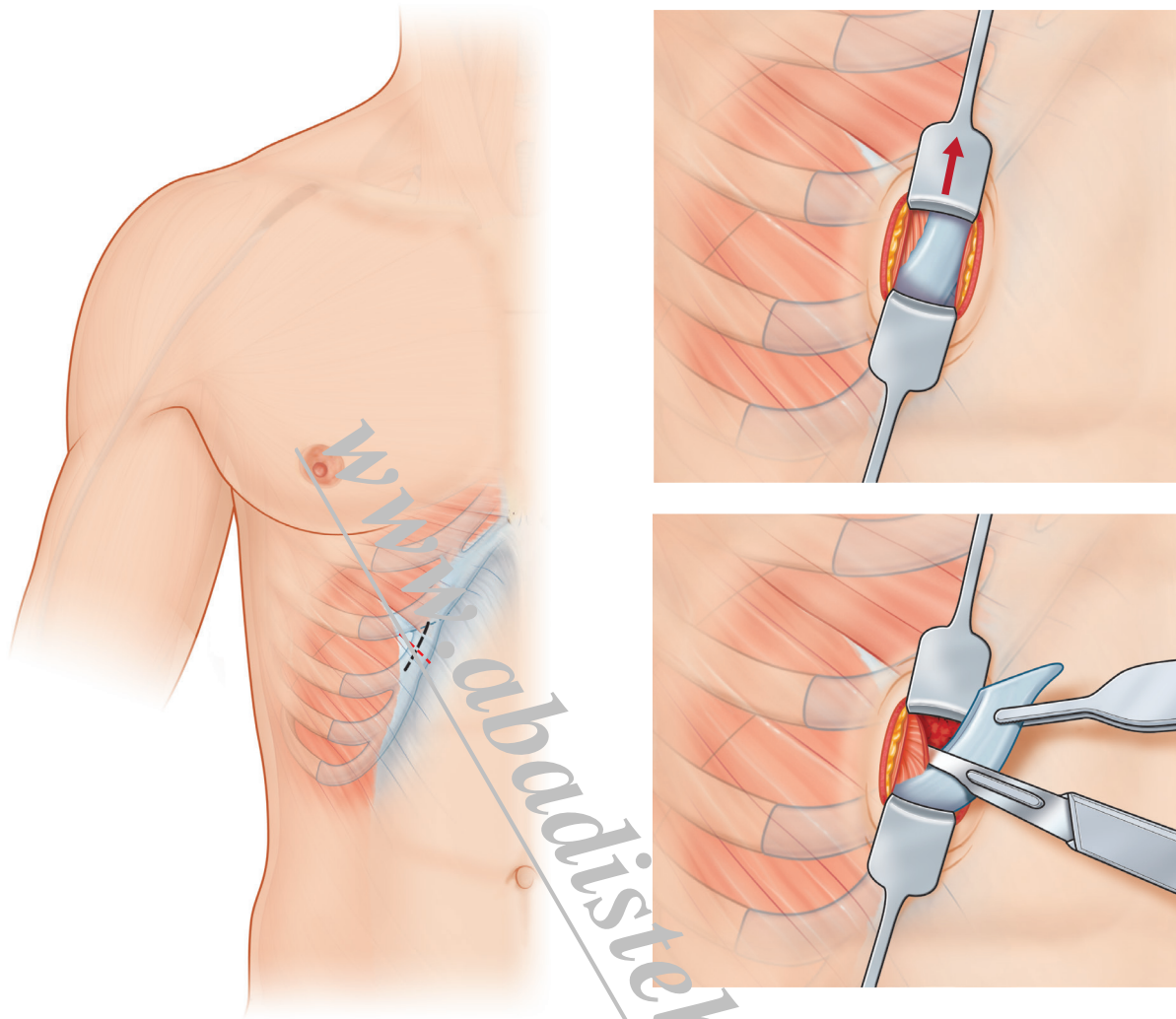
Various authors<sup>63–66</sup> have described harvesting costal cartilage from different ribs, but it is our preference to harvest the 9th rib because it is straight medially and provides 4–5 cm of autogenous graft material (Fig. 19.12). The 9th rib is a floating rib and can be located by palpation. A 2-cm incision is made on the anterolateral aspect of the chest wall. Since the skin overlying the rib is mobile in this area, a long segment of rib can be harvested through this relatively small incision. The perichondrium is lightly scored and is dissected away from the underlying rib cartilage using both a dental elevator and a Joseph elevator. When freeing the cartilage away from the deep perichondrium, care is taken to avoid damaging the parietal pleura and creating a pneumothorax. After the amount

of cartilage needed is determined, it is harvested by incising through the rib using a No. 15 blade scalpel. Slightly more cartilage should be harvested than what is needed because cartilage is lost secondary to carving. Hemostasis is obtained, and the perichondrium is closed using 3-0 Vicryl. The wound is closed in layers using 4-0 Vicryl followed by a 5-0 Monocryl intradermal suture. Injection of 0.25% bupivacaine into the donor site for postoperative pain control is followed by application of Steri-Strips (3M, St. Paul, MN).

If there is concern for pneumothorax during costal cartilage harvest, the wound is filled with saline and positive pressure ventilation can be performed by the anesthesia provider to ensure that there are no gas bubbles escaping from the chest cavity. If the parietal pleura has been violated, the tip of a red rubber catheter is inserted into the defect and a 3-0 Vicryl purse-string suture is performed around the catheter. The anesthesia provider performs a Valsalva maneuver while suction is applied to the red rubber catheter. As the catheter is withdrawn, the purse-string suture is tied to seal the parietal pleural defect, followed by wound closure. An upright chest X-ray should be performed postoperatively to confirm resolution of the pneumothorax.

### Temporal fascia

The anterior limit of the incision is made in line with the tragus (Fig. 19.13).<sup>53–55</sup> A posteriorly pointing, V-shaped incision is used as this gives the widest exposure for the subcutaneous dissection. The incision is approximately 5 cm in craniocaudal dimension and spans approximately 2.5 cm in anteroposterior dimension. The skin of the scalp is infiltrated with 5 mL of 1% lidocaine with epinephrine. The skin is incised down through the temporoparietal fascia to expose the deep temporal fascia. A needle tip electrocautery is used to dissect the areolar tissues off the superficial surface of the deep temporal fascia. An attempt should be made to harvest the largest piece of temporal fascia possible. This involves incising the temporal fascia close to the temporalis muscle's attachments to the skull periosteum superiorly and posteriorly and where it begins to divide into deep and superficial layers anteriorly. The temporal fascia should be harvested inferiorly to the level of the ear.



**Figure 19.12** Harvesting costal cartilage.



**Figure 19.13** Harvest of temporal fascia.

Although this area is about 8×6cm in dimension, temporal fascia contracts significantly and this generally yields a temporal fascia graft that is about 5×4 cm in dimension. The deep temporal fascia is incised with the needle tip electrocautery and then swept off the underlying temporalis muscle. Muscle fibers should not be harvested with the temporal fascia graft. Hemostasis is obtained, and the skin is closed in layers with 3-0 Vicryl inverted deep dermal sutures followed by a running 4-0 chromic gut suture.