VOLUME TWO

Pediatric Plastic SURGERY

SERAFIN • GEORGIADE

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Pediatric Plastic Surgery

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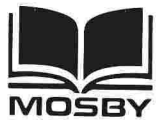

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To our wives

Patricia Serafin

and

Ruth Georgiade

FOREWORD

Pediatric Plastic Surgery, by Drs. Serafin and Georgiade, will undoubtedly become the landmark text in the field. The editors have prepared a text that encompasses the entire subject of pediatric plastic surgery and have sought the most authoritative contributors available to prepare each section. It is an all-inclusive undertaking, with 70 chapters and 65 primary authors. The thoroughness with which the editors have prepared this book is emphasized in the initial sections on special diagnostic considerations in infants and children, including radiographic imaging. The unique fluid and electrolyte requirements in this age group are described in detail, as are the unique problems relative to pediatric anesthesia. Special emphasis is placed on disorders of hemostasis in children and their appropriate management. Of growing significance are the psychologic aspects of various surgical disorders, and these are commendably covered in one chapter.

This is an invaluable reference. The editors have not only included classic topics in the field of plastic and maxillofacial reconstructive surgery, but have also wisely included problems in the fields of general and thoracic pediatric surgery, neurosurgery, orthopedics, otolaryngology, gynecology, and urology.

The breadth and scope of coverage in this new text are further underscored by attentive detail in the embryologic, epidemiologic, and genetic considerations in the pediatric age group. The many recent advances are presented, including the pioneering and now established composite tissue transplantation by microsurgical techniques. Drs. Serafin and Georgiade have made many basic contributions to the development of tissue transplantation in the microsurgical research laboratory in the Division of Plastic, Maxillofacial, and Reconstructive Surgery at Duke University. Moreover, this laboratory has been a resource for many others who have worked there and have applied the techniques of modern microvascular surgery. The Duke University Medical Center is fortunate to have such a strong program in this field under the direction of Dr. Nicholas G. Georgiade, representing as it does an extremely large and varied clinical service with an outstanding residency training program and research effort. These features are emphasized in the chapters prepared by the members of the current faculty, as well as former Duke University residents now in academic positions elsewhere.

Finally the editors are to be highly commended for seeking the most outstanding authorities in the field to prepare the appropriate chapters. It can be confidently predicted that this text will become the gold standard in the field, and it will be a must for all those engaged in pediatric plastic surgery.

David C. Sabiston, Jr.

PREFACE

YESTERDAY AND TODAY

The impetus for preparation of this text, begun several years ago, was provided by new developments during the past decade in plastic, reconstructive, and maxillofacial surgery that had specific applicability to children. Ralph Millard and Peter Randall's contributions to the surgical management of cleft lip and palate deformities and Miguel Orticochea's pharyngoplasty to correct velopharyngeal incompetence, to name only a few, stimulated renewed interest in the treatment of these complex problems. The improvement of surgical technique alone was only a small part of the total contribution. Cleft palate teams were organized with contributions from speech therapists, clinical psychologists, and orthodontists. Paul Tessier, the pioneer and founder of craniofacial surgery, excited the medical world with his revolutionary in-depth assessment and surgical management of these complex anomalies. Craniofacial centers developed throughout the world, and teams of individuals responsible for total patient care developed, structured in a similar manner to cleft palate teams.

Also during the last decade, techniques in microsurgery and the musculocutaneous flap concept revolutionized the reconstruction of extensive defects. Musculocutaneous flap closure in infants with spinal dysraphism and abdominal wall abnormalities became possible. The replantation of amputated digits and parts of infants and children was also accomplished with predicted viability. Microsurgical techniques were employed to treat peripheral nerve injuries and brachial plexus injuries related to birth accidents or trauma. Microsurgical composite tissue transplantation also became an acceptable treatment modality. Portions of digits and hands, amputated in utero or the result of adverse environmental conditions affecting the developing embryo, could now be successfully reconstructed using vascularized autogenic donor tissue. Thus a toe became a thumb, a fibula replaced a congenitally absent radius, and an intraabdominal testicle was transplanted to the scrotum and revascularized.

Directors of plastic surgery training programs throughout the world became concerned and also quite anxious by the rapidly increasing amount of information and new techniques that had to be translated to the resident experience. Operating on children at a younger age made a precise understanding of nutrition and fluid and electrolyte balance imperative. The importance of a strong surgical background before entering a plastic surgery residency was again emphasized. Postresidency fellowships that refined specific skills were created to augment training deficiencies. Thus as the burgeoning wealth of experience and information became available, it was evident that a compilation of this information would be useful. It was also apparent that such an accumulation of information transcended any single specialty interest.

Although this text has specific applicability to the experienced plastic surgeon operating on pediatric patients, it has applicability to other specialties as well. Because of the variety of problems that occur in this age group and, at times, the infrequency of occurrence, experiences from other specialties were often consolidated. Thus the neurosurgeon, gynecologist, urologist, and plastic surgeon may work together on a specific problem, each member of the team contributing specific expertise. The text has been prepared so that it deliberately crosses the previous guidelines defining the limits of any given surgical specialty. Any individual or member of a team contributing specific expertise to the treatment of any given problem must understand, as well, the contributions of other members of the team. Interest, knowledge, and experience dictate the relative contribution of each team member.

The text is divided into six major sections. *Section I*, Homeostasis, Disequilibrium, and Stress, consists of information essential to the surgical management of the pediatric age group. Emphasis is placed on factors affecting coagulation, fluid and electrolyte balance, and the assessment and management of the acutely ill and injured child.

Section II, Head and Neck, consists of chapters written by a variety of specialists whose different backgrounds and

training exemplify the concept of the team approach in the treatment of the total patient. Thus speech therapists, orthodontists, clinical psychologists, plastic surgeons, and neurosurgeons combine their various disciplines in the treatment of these extensive congenital defects. An in-depth discussion is not possible without important contributions from the basic sciences. This is no better exemplified than in the chapters dealing with embryology of the head and neck and growth alterations of the craniofacial skeleton.

Section III is primarily devoted to problems in the pediatric age group involving the trunk. Again, the various contributions from neurosurgery, pediatric surgery, thoracic surgery, and plastic surgery are combined in a comprehensive treatment approach.

Section IV, Genitalia, describes the diagnosis and treatment of ambiguous genitalia with contributions from gynecologists, urologists, and plastic surgeons. This combined approach underlines the concept that the surgical exercise alone is merely that, an exercise, without an in-depth understanding of the genetic basis and pathophysiologic process of the various abnormalities. Management of hypospadias and epispadias without a thorough familiarity with problems related to the upper urinary tract is no longer consistent with good medical care. The efforts of urologists and plastic surgeons working together ensure an optimal result.

Section V, Upper Extremity, also represents the contributions of specialists both in orthopedics and plastic surgery. The management, evaluation, and surgical treatment of a child with congenital limb anomalies or extensive injuries of the upper extremity are detailed.

Section VI is devoted to problems of the lower extremity. Congenital problems, as well as those related to extensive trauma, are detailed and the surgical management is outlined.

During the present decade, the geometric increase of scientific information and escalating frequency of medical litigation have necessitated a multidisciplinary approach in total patient care. Consequently, any book whose objective is to provide the most complete compilation of material available on any given subject must, by necessity, contain multispecialty and multinational contributions. This text represents the combined efforts of more than 100 authors residing in six countries. In preparing the text, the editors' tasks were to define special problems of interest to pediatric plastic surgeons and to select those authors who would best provide their singular experience and expertise. A successful, integrated text therefore depends on the proper selection of subject matter and authors and the manner in which divergent subjects are blended in the construction of the whole. Thus isolated notes and bars are assimilated to form a musical score. Then talented musicians with their diverse musical instruments are selected, coordinated, and integrated. The editors, merely enthusiastic conductors, await the audience's reaction as the orchestra performs the completed symphony.

TOMORROW

Pediatric Plastic Surgery is the first comprehensive textbook published that coordinates the experiences of different specialties toward the surgical solution of both common and complex problems seen in infants and children. Total patient care managed by the team approach is emphasized throughout the text.

Both the strengths and weaknesses of plastic surgery as a specialty reside in the treatment of multiple problems involving different age groups and sexes. It requires a wide perspective, a broad training base, and the constant reassessment of the ever-changing medical horizon. A pediatric plastic surgeon must also have that broad base of specialization, but yet specific refinements in skills that make his or her contribution to the total care of the pediatric patient distinctive and unique. Preservation of plastic surgery as a specialty or pediatric plastic surgery as a discipline of that specialty will be possible in the future only if well-qualified individuals with a broad training base and specific expertise continue to make the vast number of contributions so well demonstrated during the past decade. Excellence in treatment and leadership is not a static process but a continuum. The weaknesses of a broad specialty become apparent only if the contribution is casual or superficial. Progress ceases when creativity is stifled, and the in-depth assessment of challenging problems is avoided.

The accomplishments of the past decade are now history. Future accomplishments will use this past experience, accommodating emerging technology and new discoveries. Surgical techniques for treatment of the cleft lip and palate deformity are now standardized. No doubt further refinements in technique will be forthcoming, particularly with regard to treatment of the cleft lip nasal deformity. Future investigations will also be directed toward the orthodontic and surgical treatment of maxillary hypoplasia and related alterations in growth of adjacent soft tissue. Previous experiments have demonstrated that an alteration of mesodermal migration contributes to cleft formation. It is anticipated that further research will be directed toward the prevention of cleft formation in utero and on the identification of those factors which result in its formation. Concurrently, the genetic basis and environmental influences that adversely influence normal development will be better defined. In the not too far distant future, complex genetic codes on chromosomes will be isolated and altered, perhaps removing the stimulus for cleft formation. The complex combinations and permutations of genetic coding will be simplified with computer technology. Treatment will be directed at a cellular or biochemical level. Similarly, the growth alterations of craniofacial abnormalities will be better understood. Premature suture closure will be prevented, and cells of the

cranial base will be stimulated to prevent developmental hypoplasia of adjacent bony structures. Recent investigations in the etiology of hemifacial microsomia, outlined in this text, reflect the current interest and future direction of investigation toward the prevention of this and related anomalies.

It is well demonstrated both clinically and experimentally that axon regeneration proceeds more rapidly in children than in adults. Factors contributing to this accelerated growth, however, are poorly understood. Growth factors and the effects of changing electrical potential on precursor cells have been postulated. The cerebral cortex, an uncharted topographic map of hills and valleys still undisturbed by outside environmental influence, is fertile territory in children awaiting incoming messages. Sensory reeducation after peripheral nerve injury and repair is facilitated in the child. In the future, differences in nerve regeneration between children and adults will be better understood. This information will be used to regulate and accelerate axon regeneration after peripheral nerve and brachial plexus injuries. The advent of neuromicrosurgery in the past decade has expanded treatment modalities and understanding of these problems. One could anticipate that in the future infinite magnification will be employed at a cellular or biochemical level.

The immature organism, in contrast to a mature adult, has an enhanced capacity for cell dedifferentiation and regeneration. This is well demonstrated in lower phyla. In immature amphibians, amputation of a segment or part will result in the restoration of that missing part by regeneration. One can anticipate that in the future, amputated parts or segments of tissue in children will be replaced by autogenous tissue whose growth and development will be controlled by individuals skilled in genetics and cellular biology.

In the not too distant future immunosuppression will be replaced by specific immunoregulation. The recent discovery of cyclosporin A and its effect on helper T cells and suppressor cells has provided considerable information toward the controlled manipulation of the immune system. Allogeneic renal and liver transplantation in children is currently an accepted treatment modality. One can anticipate that in the future other allogeneic sources of tissue will be used to replace diseased or congenitally deficient autogenous tissues. Allogeneic islet cell transplantation is also possible in the near future.

The plastic surgeon will become more of a basic scientist in the next two decades. Treatment will be directed at a cellular level. Specialized training in areas other than surgical skills will be emphasized in postgraduate studies.

In the distant future, with the advent of new technology and an increased interest in the biochemical and cellular bases for disease, the pediatric plastic surgeon of today will be extinct. Treatment modalities will be directed at a cellular or biochemical level by individuals skilled in immunology, genetics, biochemistry, and cellular physiology. The skilled surgical technician will be replaced by the scientist. Treatment modalities will be infinitely more specific, refined, and sophisticated. Lasers will replace scalpels. Genetic information will be rearranged, and immature stem cells will be guided electronically toward organ and part replacement.

Donald Serafin
Nicholas G. Georgiade

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As work on a major text is completed, editors often reflect on the countless hours and numbers of people that have made completion of such a task possible. Certainly an inclusive multiauthored text is successful only if its content and direction fulfill the basic goals and criteria responsible for its preparation. Writing a chapter for a textbook is an arduous task and is frequently an act of love and dedication. Textbook chapters, although they enhance an individual's bibliography, are frequently not considered in the same category as original articles in refereed journals. Yet such a chapter may be more inclusive and actually represent an individual's total professional experience, unequaled by any other contributor. We wish to sincerely thank all the contributing authors who have given their time and shared their knowledge to make completion of such a task possible. Approximately half of the contributing authors are members of the full-time and part-time attending staff at Duke University Medical Center. Many are members of the Department of Surgery. We wish to thank these colleagues and the Chairman of the Department, David C. Sabiston, Jr., for continued support and encouragement. Significant contributions also came locally from the faculty of Medicine and Dentistry of the University of North Carolina at Chapel Hill. Heartfelt thanks are also offered to more distant colleagues both nationally and internationally who responded when their specific expertise and contributions were requested.

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