
Preface

When I first began my career as a pediatric nuclear medicine physician over 42 years ago, I could never have imagined the incredible advances that have taken place in the field; nor could I have imagined that I would have played even the smallest role in bringing this nascent imaging discipline to the fore of the radiologic sciences. Today, nuclear medicine offers critical diagnostic and treatment capabilities that benefit children. In recent years, nuclear medicine has evolved to include molecular imaging.

As the founder and chief of the Division of Nuclear Medicine and Molecular Imaging at Boston Children's Hospital (1970–2011), I have witnessed breathtaking technological advancements that have had impressive clinical impact – changes that have translated swiftly into improved patient care and outcomes. This amazing progress has enriched the field and led us now to the innumerable opportunities that lie ahead.

It has been nearly 30 years since the first edition of *Pediatric Nuclear Medicine* was published. It has been followed by a new edition nearly every decade since, updating the changes and advances within the field. This edition is entitled *Pediatric Nuclear Medicine and Molecular Imaging* to reflect the development and progression of the field during the last decade. I have been very fortunate to have contributions from colleagues all over the world, whose expertise and experiences enrich this edition. It has been exciting and a pleasure to once again assemble the current principles of pediatric nuclear medicine and share with readers new developments in this fourth edition.

The unique features and capabilities of pediatric nuclear medicine and molecular imaging significantly contribute to the diagnosis of many diseases in children. Pediatric nuclear medicine procedures reveal physiological processes *in vivo*. They permit early detection of disease, help patient management and therapeutic decisions, and have become increasingly important tools to follow the success of therapy or to assess progression of disease. Nuclear medicine provides information about the patient's condition by physiological, sensitive, rapid, safe and minimally invasive means. Therefore, diagnostic nuclear medicine procedures are well suited for the evaluation of pediatric patients. Nuclear medicine reveals unique information about the patient's condition not easily obtained or even possible with other diagnostic methods.

In this new edition, my collaborators and I hope to update readers about the well-established applications of pediatric nuclear medicine while incorporating essential developments of the past decade. Given ongoing

advances in technology and clinical practice, it is anticipated that further developments will be incorporated into pediatric nuclear medicine and molecular imaging in the foreseeable future. There is no question that the increased use of PET/CT and SPECT/CT has influenced the practice of nuclear medicine in children. Multimodality image fusion and hybrid imaging are recognized as important aspects of the field, and this information is incorporated in the appropriate chapters. This book is designed to ensure that all aspects of functional imaging of pediatric nuclear medicine are covered and emphasized. Following the tradition of the first three editions, this book focuses primarily on pediatric aspects of nuclear medicine and, therefore, it is important to note that *it is not intended* to provide an in-depth multimodality review of all pediatric imaging.

Most chapters from the third edition have been thoroughly revised or entirely re-written and new chapters have been added as well. The first chapter covers general aspects of pediatric nuclear medicine, followed by chapters on pediatric sedation and general anesthesia, pediatric imaging variants, central nervous system including cerebrospinal fluid, thyroid diagnosis musculoskeletal system, hepatobiliary system, lymphatic system, parathyroid imaging, cardiopulmonary system, gastrointestinal system, genitourinary system, infection and inflammation, oncologic disorders, instrumentation, measurement of glomerular filtration rate, image processing, radiation doses, and risk. Finally, there is a chapter on molecular imaging in pediatrics.

Radionuclide therapies in thyroid disorders and neuroblastoma with ^{131}I in children have also been incorporated in this edition. A characteristic of pediatric nuclear medicine is that normal values in children are difficult to obtain, as healthy patients cannot be studied easily with these techniques due to ethical and other inherent concerns relating to the use of radioactive materials. However, whenever possible, an effort is made to incorporate normal values within the appropriate chapters.

Clinical investigation in children is necessary in order to advance the understanding and derive the maximum benefit of nuclear medicine in pediatrics. However, as stated previously, radioisotope research in children, although possible, is quite limited in scope and depth. On the other hand, the use of small animal imaging provides the opportunity to explore, in serial non-destructive testing, mechanisms of disease, elucidation of biokinetics, pharmacology and metabolism in appropriate animal models. The use of such multimodality and multidisciplinary facilities provides ways to explore, discover and innovate on many issues related to pediatric disorders in ways not possible otherwise. This approach can enable exploration of problems and ideas that originate from the bench to the bedside and from the bedside to the bench.

In recent years, interest in the potential risks from radiation exposure to pediatric patients from the use of imaging methods employing ionizing radiation has increased. This has been a concern of members of the scientific community, government, lay press and the general public. This has led to the formation of the Image Gently campaign (www.imagegently.org). The mission of the campaign is to raise awareness, educate and advocate for the need to promote radiation protection for children worldwide. This edition adheres

to this mission and includes ways to communicate potential radiation risk to patients, families and members of the healthcare team. In addition, this book discusses means to optimize pediatric radiopharmaceutical administered doses and to reduce patient radiation exposure.

We sincerely hope this fourth edition of *Pediatric Nuclear Medicine and Molecular Imaging* will be a valuable resource to physicians, students, nurses, technologists and others involved in the care of pediatric patients.

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<http://www.springer.com/978-1-4614-9550-5>

Pediatric Nuclear Medicine and Molecular Imaging

Treves, S.T. (Ed.)

2014, XXIV, 712 p. 424 illus., 149 illus. in color.,

Hardcover

ISBN: 978-1-4614-9550-5