
Radionuclide Parathyroid Imaging

Qaisar Hussain Siraj
Editor

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Book and Atlas

 Springer

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Preface

The only source of knowledge is experience. (Albert Einstein)

The *Radionuclide Parathyroid Imaging: Book and Atlas* is the first dedicated comprehensive book and atlas on radionuclide parathyroid imaging. It is designed as a ready reference on the use of parathyroid scintigraphy in patients with hyperparathyroidism, both for the localisation of parathyroid pathology and as an aid to surgery. The introductory chapters (Chaps. 1–5) review the basic core knowledge on the subject including parathyroid anatomy, embryology, and histology (Chap. 1), parathyroid physiology (Chap. 2), hyperparathyroid disorders (Chap. 3), the current structural diagnostic imaging modalities (Chap. 4), and parathyroid scintigraphy (Chap. 5). Chapter 6 highlights the utility of the ^{18}F -Choline PET/CT in the localisation of hyperactive parathyroid pathology; Chap. 7 includes the atlas of cases of parathyroid scintigraphy, and Chap. 8 includes ^{18}F -Choline parathyroid PET/CT example cases.

A total of 80 case reviews are presented, covering gamma camera planar imaging, SPECT, hybrid SPECT-CT, and also PET-CT. Illustrations and figures comprising line drawings, greyscale photos depicting nuclear medicine, and CT images and dual-modality fusion colour photos are included. This compilation of illustrative clinical cases will greatly assist clinicians and imaging specialists in image interpretation in different settings. The images replicate normal conventional formats used for routine reporting and hence facilitate fast and reliable diagnosis. Each of the case reviews includes documentation of the procedure, findings, and conclusions with relevant commentary. Surgeons, physicians, endocrinologists, nephrologists, nuclear medicine physicians, and radiologists will find this book and atlas on radionuclide parathyroid imaging to be a valuable practical tool and learning aid.

This book represents my many years of experience with parathyroid scintigraphy. There is a wide range of cases included in the atlas section with many rare and a large number of previously unreported cases. The use of planar thallium/technetium subtraction scan for the diagnosis of sestamibi-negative parathyroid adenomas has not been previously reported, nor have the several cases of sestamibi-negative scan results in patients with parathyroid adenomas which were successfully imaged with thallium parathyroid SPECT/CT imaging. This defines a new role of thallium parathyroid SPECT/CT imaging in patients with primary biochemical hyperparathyroidism with sestamibi-negative scan results. Thallium SPECT/CT can also at

times help in localisation of sestamibi-negative parathyroid hyperplasia though in general sestamibi parathyroid imaging is preferable in patients with secondary hyperparathyroidism.

The increasing popularity of the new surgical approach of minimally invasive parathyroid surgery technique, which has evolved in tandem with the introduction of accurate and sensitive preoperative localisation techniques and intraoperative gamma probe localisation of the overactive parathyroid lesions, has revived the need for preoperative parathyroid localisation with the hybrid SPECT/CT radionuclide techniques still leading the diagnostic first-line imaging modalities.

We present SPECT image processing and optimisation methods with special emphasis on logarithmic inverse greyscale image conversion, which expands the values of high pixels and compresses the values of low pixels thereby enhancing the modest increase in uptake in the parathyroid lesions and suppressing the background thyroid activity. This together with appropriate colour display improves the identification of the smaller hyperactive parathyroid glands, both adenomatous and hyperplastic, thereby considerably increasing the sensitivity of parathyroid scintigraphy. Retrospective and prospective application of inverse-log transformation has very significantly improved our diagnostic yield and reduced the false-negative rate to a minimum.

The hybrid functional/structural imaging further improves the identification of lesions that only show a subtle increase in the radionuclide uptake or are too small to resolve individually on scintigraphy alone. This also aids in the identification of a sestamibi-non-avid lesion for subsequent thallium-201 SPECT/CT in cases with non-oncogenic cell hyperactive parathyroid lesions.

Due to the wide availability of the current automated laboratory biochemistry procedures, the diagnosis of hyperparathyroidism is now being made at an early stage in the disease, when most patients are yet asymptomatic. Biochemical hypercalcaemia and hyperparathyroidism are diagnostic, but increasingly normal or borderline sporadic elevations in serum calcium with inappropriate PTH elevation are the only clue to what is now termed as eucalcaemic or normocalcaemic hyperparathyroidism. This coupled with widespread vitamin D deficiency, which results in an increase in the PTH in the presence of normal serum calcium, makes the diagnosis somewhat confounding. The atlas cases are interpreted in the light of comprehensive biochemical analyses, which helps elucidate the complex interplay between various factors and allows identification of the cause of primary, secondary, and tertiary hyperparathyroidism due to benign or malignant parathyroid disease.

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This work has encompassed the last 36 years of my clinical career starting in 1982 with thallium/technetium parathyroid imaging at the Royal Free Hospital, London, under the guidance of my teacher and mentor Dr. AJW Hilson. And later when I first introduced parathyroid imaging in Pakistan at the Nuclear Medical Centre, AFIP Rawalpindi, I was readily helped by surgeons and pathologists and I thank the trust shown to me by my many patients who made this endeavour so rewarding. This work continued in several NHS teaching hospitals in London, but a substantial volume of work was performed at the Royal Hospital Haslar and the Portsmouth Hospitals NHS Trust, and I am indebted to my surgical colleagues there for their close collaboration (particularly Dr. Martin Wise) and my technical colleagues (especially Paul Griffiths) for their efforts in producing high-quality images. There are several other colleagues, too numerous to name, who were involved in this work over the years, and I gratefully acknowledge their help. I thank Miss Smitha Diveshan and Mr. Deepak Srinivasan from Springer for their advice and assistance.

Finally, I am grateful to my family for their understanding during my preoccupation with my writing to the exclusion of other duties. A Special Grace buoyed me during writing of this book and made the long hours bearable and indeed pleasurable. This undertaking was by itself quite rewarding as new subtleties were revealed and complexities unravelled.

Dr. Qaisar Hussain Siraj

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