Radionuclides in Nephrology

Proceedings of the IIIrd International Symposium Berlin, April 1974

Edited by
Karl zum Winkel, M. Donald Blaufox
and Jean-Louis Funck-Brentano

Associate Editors
David I. Goldsmith and Sebastian Lange

205 Figures, 91 Tables

Radionuclides in Nephrology

Proceedings of the IIIrd International Symposium
Berlin, April 1974

Edited by
Karl zum Winkel, M. Donald Blaufox
and Jean-Louis Funck-Brentano

Associate Editors
David I. Goldsmith and Sebastian Lange

205 Figures, 91 Tables

Georg Thieme Publishers Stuttgart 1975

CIP-Kurztitelaufnahme der Deutschen Bibliothek

Radionuclides in nephrology : proceedings of the IIIrd Internat. Symposium Berlin, April 1974 / ed. by Karl zum Winkel [u.a.]
ISBN 3-13-521301-3
NE: ZumWinkel , Karl [Hrsg.]

Printed in Germany by Franz Pistotnik, Gerlingen

ISBN 3-13-521301-3

Preface

The IIIrd International Symposion Radionuclides in Nephrology was held in Berlin on April, 1.–3. 1974 under the sponsorship of the Ministerium für Forschung und Technologie of the Federal Republic of Germany. This meeting was attended by 130 participants from 18 different nations and was organized by Dr. Karl zum Winkel (Germany) the chairman of the scientific committee, which included Dr. M. Blaufox (USA), Dr. J.-L. Funck-Brentano (France), Dr. A. Joekes (Great Britain), Dr. T. Minami (Japan), Dr. O. Munck (Denmark) and Dr. R. Nagel (Germany).

The first international meeting devoted to Radionuclides in Nephrology was held in Liege, Belgium (1968).

The continued interest in this subject of research and clinical application led to the second meeting in New York City (USA, 1971) and warrants periodic international meeting of scientists working in this area.

Many types of inquiry in clinical and basic sciences are important for the maintainance and development of sound standards for the use of radionuclides in nephrology. Therefore, the program of the meeting covered a wide range of topics: Renal blood flow, Functional and morphological studies, Radioimmunoassay, Renal transplantation, Renal handling of radioactive compounds, Metabolic studies in renal disease and Clearance determinations.

During the last decade nuclear medicine has been the fortunate recipient of the benefits of a rapidly improving technology and impressive progress in biochemical methodology. The overwhelming variety of methods presently used in kidney research was demonstrated at the symposium. The techniques included electron microscopy, kidney microdissection, radioimmunoassay, autoradiography, ultrasonography, clearance determinations, kinetic analysis of radiopharmaceuticals and computational data processing.

We all look forward to the further progress which will be reviewed at the next Symposium 1977 in Boston (USA) under the chairmanship of Dr. N. Hollenberg and the co-chairmanship of Dr. O. Munck. We hope, that the proceedings of the Symposium will be useful to scientists and physicians who did not have the opportunity to come to Berlin, and that they will promote the understanding of this exciting field. We are indebted to all of the contributors to the symposium. Their promptness and cooperation have made it possible to complete this text within a short time.

We would also like to thank Dr. h.c. G. Hauff, Georg Thieme Verlag, who has helped to make this publication possible.

The Editors *Karl zum Winkel*
M. Donald Blaufox
J.-L. Funck-Brentano

Editors

Karl zum Winkel, M.D.
Professor für Klinische Radiologie, Direktor des Strahleninstitutes der Freien Universität Berlin im Klinikum Charlottenburg

M. Donald Blaufox, M.D., Ph. D.
Associate Professor of Medicine and Radiology, Albert Einstein College of Medicine; Director, Division of Nuclear Medicine, Albert Einstein College of Medicine; Attending Physician, Bronx Municipal Hospital Center, Bronx, New York

Jean-Louis Funck-Brentano, M.D.
Professeur à la Faculté de Médicine, Necker-Enfants-Malades, Paris, France; Directeur de l'Unité de Recherches sur l'Application des Radio-éléments à l'Etude des Maladies Métaboliques, INSERM, U 90, Paris, France

Associate Editors

David I. Goldsmith, M.D., Assistant Professor of Pediatrics, Division of Pediatric Nephrology, Albert Einstein College of Medicine, Bronx, New York

Sebastian Lange, M.D.
Assistenzprofessor, Strahleninstitut der Freien Universität Berlin im Klinikum Charlottenburg

Acknowledgments

This symposium was sponsored by the Ministerium für Forschung und Technologie der Bundesrepublik Deutschland.
Further grants were given by the following organizations:

Amersham Buchler, Braunschweig; Bayer, Leverkusen; Boehringer, Mannheim; BYK Gulden, Konstanz; BYK Mallinckrodt, Dietzenbach-Steinberg; Farbwerke Hoechst, Frankfurt; Grünenthal, Stolberg; Dr. Madaus, Köln; C.H.F. Müller, Hamburg; Schering, Berlin; Siemens, Erlangen; Dr. Thomae, Biberach.

Participants

Austria

Dienstl, Elisabeth, Allg. Öffentl. Krankenhaus, Nuklearmedizinisches Labor, 4020 Linz/Donau, Krankenhausstr. 9

Erd, Werner, 2nd Medical University Clinic, 1090 Vienna, Garnisongasse 13

Pohl, Landeskrankenhaus Salzburg

Belgium

Mahieu, Philippe, Hôpital de Bavière, 66, B^{d}. de la Constitution, 4000 Liège, Université de Liège

Petit, René, Hôpital de Bavière, Urologie, 66, B^{d}. Constitution, 4000 Liège, Université de Liège

Piepsz, Amnon, University of Brussels, 148, Av. des Traquets, 1150 Bruxelles

Schoutens, André, Hôpital Brugmann, 4, Place van Gehuchten, 1020 Bruxelles

Timmermans, Leopold, Université de Liège, 196 R. Général Jacques, Vaux, Chévremont B 4601

van Vaerenbergh, Maurits, Oude Vierschaarstraat 18, 9831 Deurle

Verhas, Michel, Hôpital Brugmann, Dépt. Isotopes, Place van Gehuchten, Bruxelles

Willems, Jacqueline, Hôpital Bavière, 66, B^{d}. de la Constitution, 4000 Liège, Université de Liège

Bulgaria

Andreew, Ignat, Nephrologische Klinik der Med. Akademie, Sofia, Straße Ilia Filipossni 4

Canada

Carriere, Serge, University of Montreal, Montreal

Denmark

Brøchner-Mortensen, Jens, Department of Clinical Physiology, Aalborg Sygehus Syd, 9000 Aalborg

Kristiansen, Jan Hardan, Pilevej 37, Korup, University Hospital, Odense

Ladefoged, Jørgen, Rigshospital AFD. P, Blegdamsve 9, 2100 Copenhagen

Munck, Ole, Dept. Clinical Physiology, Glostrup Hospital, 2600 Glostrup

Ølgaard, Klaus, Rigshospitalet, Med. Dept. P, Blegdamsve 9, 2100 Copenhagen

Tönnesen, Knud Henrik, Glostrup Hospital, 10 Nyhavn, 1051 Copenhagen

France

Bankir, Lise, INSERM U 90 Hôpital Necker, 161 Rue des Sèvres, 75015 Paris

Barjon, Paul, Cliniques St. Charles, 34059 Montpellier Cedex

Chanard, Jacques, Hôpital, Necker, Département de Néphrologie, 161 Rue de Sèvres, 75015 Paris

Devynck, Marie, Hôpital Necker, Pharmacologie et Physiologie, INSERM U 7, 161 Rue de Sèvres, Paris

Drüeke, Tilman, Hôpital Necker, Département de Néphrologie, 161 Rue de Sèvres, Paris

Fressinaud, Philippe, Hôpital Necker, INSERM, 17 Rue du Fer à Moulin, 75014 Paris

Funck-Brentano, Jean-Louis, Hôpital Necker, 161 Rue de Sèvres, Paris

Grünfeld, Jean-Pierre, Clinique Néphrologique, Hôpital Necker, 161 Rue de Sèvres, Paris 15

Osborne-Pellegrin, Mary, Hôpital Necker, INSERM U 7, Physiologie et Pharmacologie, 161 Rue de Sèvres, Paris 15e

Perrine, Donald, Intertechnique, St. Nom la Breteche

Raynaud, C., C.E.A. 91406 Orsay Commissariat à l'Energie Atomique Département de Biologie Service Hospitalier Frédéric Joliot

de Rouffignac, Christian, Commissariat a l'Energie Atomique, Département de Biologie– L.P.P.C., Centre d'Etudes Nucléairs de Saclay, BPu02 – Gif sur Yvette, 81

Sabto, Joseph, Hôpital Necker, Clinique Néphrologique, 161 Rue de Sèvres, Paris 15e

Sraer, Josèe, INSERM Unit, Hôpital Tenon, 4 Rue de la Chine, Paris 20e

Germany

Albert, Jens-Peter, Institut für klinische und experimentelle Nuklearmedizin der Universität Bonn, 53 Bonn 1, Venusberg

Baethke, Reinhard, Klinikum Westend der FU Berlin, Berlin 19, Spandauer Damm 130

Bahlmann, J., Institut für Nuklearmedizin und Spezielle Biophysik, Med. Hochschule, 3 Hannover, Karl-Wiechert-Allee 9

Beuerlein, Ingrid, Allgemeines Krankenhaus Harburg, 2104 Hamburg 92, Fritz-Döhling-Weg 3c

Bohle, Adalbert, Pathologisches Institut der Universität, 74 Tübingen

Botsch, Hanno, Radiologische Abteilung, Klinikum Steglitz, 1 Berlin 45, Hindenburgdamm 30

Breuel, Hans-Peter, Medizinische Universitäts-Klinik, 34 Göttingen

Endon, Hitoshi, Pharmakologisches Institut der FU Berlin, 1 Berlin 33, Taubertstr. 33A

Ewe, Sigurd, Nuklearmedizinische Abteilung, Krankenhaus Spandau-Nord, 1 Berlin 20, Lynarstr. 12

Grebe, Siegfried, Univers. Dep. of Nuclear Medicine, 63 Gießen, Friedrichstr. 27

Hast, Björn, Klinik und Poliklinik für Radiologie der Universität München, 8 München 2, Ziemssenstr. 1

Heidenreich, Peter, Nuklearmedizinische Klinik rechts der Isar, 8 München 80, Ismaninger Str. 20

Heinze, Hans Georg, Klinik und Poliklinik für Radiologie der Universität, München 2, Ziemssenstr. 1

Helmchen, Udo, Pathologisches Institut der Universität, 74 Tübingen

Hierholzer, Klaus, Dept. of Clinical Physiology, Freie Universität Berlin, Klinikum Steglitz, 1 Berlin 45, Hindenburgdamm 30

Höft, Karl, Fa. Elscint GmbH, 62 Wiesbaden-Schierstein, Freudenbergstr. 27

Hör, Gustav, Nuklearmedizinische Klinik der Technischen Universität, 8 München 80, Ismaninger Str. 22

Hünermann, Bernd, Institut für Nuklearmedizin Bonn, 505 Porz, Westhoven, Rheinaustr. 5

Jost, Heidemarie, Strahlenklinik und Poliklinik der Freien Universität Berlin, Klinikum Westend, 1 Berlin 19, Spandauer Damm 130

Kessel, Michael, Medizinische Universitäts-Klinik, Klinikum Westend, 1 Berlin 19, Spandauer Damm 130

Koszik, Friedrich, Fa. von Heyden GmbH München, 8031 Geiselbullach, Schmidtstr. 65

Kracht, Heinz, Urologische Abteilung, Friedniherstift, 3 Hannover, Gustav-Adolf-Str. 22

Kretschko, Julius, Nuklearmedizinische Klinik und Poliklinik rechts der Isar der Technischen Universität, 8 München 80, Ismaninger Str. 22

Lange, Sebastian, Strahlenklinik der Freien Universität, 1 Berlin 19, Spandauer Damm 130, Klinikum Westend

Leisner, Bernhard, Klinik und Poliklinik für Radiologie der Universität, 8 München, Ziemssenstr. 1

Lorenz, Kurt, Fa. Picker Roentgen, 3001 Hannover-Wettbergen

Lotz, Werner, Abteilung für Radiologie der Universität, 51 Aachen

Mariss, Peter, Institut für Nuklearmedizin, 3 Hannover, Karl-Wiechert-Allee 9

Möhring, K., Urologische Universitätsklinik, 69 Heidelberg, Kirschnerstr. 1

Nagel, Reinhard, Urologische Klinik der Freien Universität Berlin, Klinikum Westend, 1 Berlin 19, Spandauer Damm 130

Nörenberg, Hans-Joachim, Städt. Krankenhaus Heckeshorn, 1 Berlin 39, Am Großen Wannsee 80

Oeff, Karl, Nuklearmedizinische Abteilung der FU Berlin, Klinikum Steglitz, 1 Berlin 45, Hindenburgdamm 30

von der Ohe, Marianne, Fa. Farbwerke Hoechst, Med. Abteilung, 6202 Wiesbaden-Biebrich, Biebricher Allee 112

Peters, Peter E., Radiologische Universitätsklinik, 44 Münster

Petersen, Friedrich, Allgemeines Krankenhaus St. Georg, Abteilung für Nuklearmedizin, 2 Hamburg 1, Lohmüllerstr. 5

Pfeifer, Klaus Jürgen, Klinik und Poliklinik für Radiologie der Universität München, 8 München 70, Wadlerstr. 8

Pixberg, Hans-Ulrich, Deutsche Klinik für Diagnostik, 62 Wiesbaden

Ritz, Eberhard, Med. Universitätsklinik, 69 Heidelberg, Ludolph-Krehl-Klinik, Bergheimer Str.

Rohloff, Ralf, Universität München, Klinik und Poliklinik für Radiologie, 8 München 80, Bayrischzeller Str. 21

Siebenmorgen, Hans, Fa. Picker Roentgen GmbH, 4992 Espelkamp, Schillerstr. 10

Sonderkamp, Horst M., Kreiskrankenhaus, 224 Heide

Sorge, Franco, Klinikum Westend der Freien Universität Berlin, 1 Berlin 19, Spandauer Damm 130

Schneider, Albert, Städt. Krankenhaus München-Neuperlach, Nuklearmedizinische Abteilung, 8023 Pullach, Seitnerstr. 4a

Schröter, Hans, Fa. R. Karl Thomae Biberach, 795 Biberach, Bachstr. 22

Schurek, Hans-Joachim, Medizinische Klinik der Freien Universität Berlin, Klinikum Steglitz, 1 Berlin 45, Hindenburgdamm 30

Schwarzendorfer, Astrid, Nuklearmedizinische Klinik und Poliklinik der Technischen Universität München, 8 München 80, Ismaninger Str. 22

Teebken, Klaus, Klinik Dr. Hancken, Nuklearmedizinische Abteilung, 216 Stade, Lönsweg 7

Trüber, Henno, Strahlenklinik der Freien Universität, 1 Berlin 19, Spandauer Damm 130, Klinikum Westend

Uhlich, Eike, II. Med. Univ.-Klinik, 8 München

Vogel, Jürgen, Fa. Byk-Mallinckrodt, Dietzenbach

Weber, Hans-Joachim, Freie Universität Berlin

Werner, Eckhard, Gesellschaft für Strahlen- und Umweltforschung, 6 Frankfurt 70, Paul-Ehrlich-Str. 20

Zieger, Karl, Städt. Krankenhaus Spandau-Nord, Nuklearmedizinische Abteilung, 1 Berlin 20, Lynarstr. 12

zum Winkel, Karl, Strahlenklinik der Freien Universität, 1 Berlin 19, Spandauer Damm 130, Klinikum Westend

Great Britain

Blacklock, Norman, Royal Naval Hospital, Haslar, Gosport, Hampshire

Britton, Keith, Institute of Nuclear Medicine, Middlesex Hospital, 64 Fortis Green, London N 29 EN

Constable, Anthony R., St. Paul's Hospital, Endell Street, London W.C. 2

Joekes, Mark, St. Peter's Hospitals, St. Philip's Hospital, Sheffield Street, London, W.C. 2

Macleod, Murdoch A., Dept. Nuclear Medicine, Royal Naval Hospital, Haslar, Gosport

Reeve, Jonathan, MRC. Clinical Research Centre, Radioisotopes Division, Watford Road, Harrow, Middlesex HA 1 3 nJ

Italy

Bianchi, Claudio, Clinica Medica Generale, University of Pisa

Semprebene, L., 11th Clinica Chirurgica-Medica, University of Rome School of Medicine

Israel

Drukker, Alfred, Shaarei Ledek Med. Center, Jerusalem, Jaffa Road

Japan

Fukuchi, Soitsu, Department of Internal Medicine, Tohoku University School of Medicine, 3-4-36 Kitayama, Sendai

Minami, Takeshi, Jikei University School of Medicine, Department of Urology, Nishishinbashi Minato-Ku, Tokyo

Miyazaki, Mizuo, Dept. of Pharmacology, Osaka City Univ. Medical School, 9–2 Machiura, Abeno, Osaka

Tanaka, Akira, National Institute of Hygienic Sciences, Department of Medical Chemistry, 1-18-1, Kamiyoga, Setagaya, Tokyo

Mexico

Alvarez, Jorge, Instituto Nacional de Energia Nuclear, Hospital "20 de Noviembre", Providencia 1229, Mexico 12

Maass, Roberto, Instituto Nacional de Energia Nuclear, Ajusco 61, Col. Alpes, Mexico 20

Netherlands

Donker, Albert, Academisch Ziekenhuis, Afd. Interne Geneeskunde, Oostersingel 59, Groningen

Oei, Hong Yoe, Academic Hospital Utrecht, Dept. of Nuclear Medicine, Catharynesingel 101, Utrecht

Schnurman, Hans, Oostersingel 59, Groningen, Isotopen Laboratorium, Academisch Ziekenhuis

van Stekelenburg, Louis H.M., Radiologischer Dienst TNO, Avenhem

Tegzess, Adam, Dept. of Internal Medicine, University Hospital, Oostersingel 59, Groningen

Norway

Falch, Dagfinn, Alcer Hospital, Vestlegon 32, Oslo 9

Norman, Nils, Aker Hospital, Hormone and Isotope, Dr. Smiths vei 14, Oslo

Rootwelt, Ksell, Rikshospitalet, University Hospital, Oslo

Sweden

Magnusson, Gösta, The Department of Nephrology, St. Erika Hospital, Stockholm

Switzerland

Bischof-Delaloye, Angelika, Hôpital Cantonal Universitaire, Div. Aut. de Médécine Nucléaire, loll Lausanne

Jucker, Arnim, Kantonsspital, 8200 Schaffhausen, Gemsgasse 9

Locher, Johannes, Kantonsspital, Nuklearmedizinische Abteilung, 4000 Basel

Skenderovic, Alois, Perolles 1, Fribourg

United States of America

Blaufox, M. Donald, Albert Einstein College of Medicine, 1300 Morris Park Avenue, Bronx, N.Y. 10461

Blight, Edward M., 2nd General Hospital, APO, New York 09180

Goldberg, Marvin, University of Minnesota, Health Sciences Center, 5049 **Abbott Ave.,** Box 382, Minneapolis, Minn. 55410

Goldsmith, David, National Najal·Med. Center, Bethesda Md., 3010 Wisconsin Ave., Washington, D.C. 70016

Gruskin, Alan, St. Christopher's Hospital for Children, 7600 N. Lawrence Street, Philadelphia Pa. 19133

Handmaker, Hirsch, Children's Hospital of San Francisco, 2616 Buchanan Street, San Francisco, Ca. 94115

Hayes, M., Division of Nuclear Medicine, Los Angeles, County Harbor Gen. Hospital Torrance, California

Hollenberg, Norman K., Harward Medical School, 721 Huntington Avenue, Boston, Mass. 0214

MacIntyre, William J., Cleveland Clinic Center, 9500 Euclid Ave., Cleveland, Ohio 44106

Katz, Murray, Univ. Arizona College of Medicine, Tucson, Arizona

Kirschenbaum, Michael A., Ohio State University Hospital, 1075 Merrimar Circle Columbus, Ohio 43220

Moser, Lawrence, Dept. of Nuclear Medicine, Intercommunity Hospital, 215 W. College, Covina, Calif. 91723

Pinter, Gabriel G., Dept. of Physiology, University of Maryland, 660 W. Redwood Street, Baltimore, Maryland 21201

Ponto, Richard A., Dept. of Radiology, University of Minnesota Hospital, Minneapolis, Minnesota 55455

Schlegel, Jorgen, Tulane Medical School, New Orleans, 1430 Tulane Avenue

Wedeen, Richard, Jersey City Medical Center, New Jersey, Medical School, 574 S. Forest Dr., Teaneck, N.Y.

Yugoslavia

Gorkic, Daroslava, 11000 Beograd, Mutapova 51/I

Contents

Part I

Renal Blood Flow

In this first of 7 sections basic and clinical informations concerning renal blood flow are presented. The interest of many authors is directed toward intrarenal blood flow distribution, which can be assessed with radionuclide labelled microspheres. Renal blood flow and its intrarenal distribution were examined under the influence of various factors, including vasoactive pharmaceuticals, hormones and alterations of extracellular volume and sodium homeostasis. Kidney lymph drainage measured with I-131-plasma albumin, has also proven to be susceptible to study.