



# TUMORS of INFANCY and CHILDHOOD

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J. B. Lippincott Company

PHILADELPHIA AND MONTREAL

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Distributed in Great Britain by  
Pitman Medical Publishing Co., Limited, London

Library of Congress Catalog Card No. 63-22562

Printed in the United States of America

**TUMORS OF INFANCY  
AND CHILDHOOD**

**To My Wife, Virginia**

## Preface

The purpose of this book is to present to the reader a combination atlas and ready-reference text covering the pathology, the pertinent clinical data and the prognosis of both common and unusual tumors found in children. By utilizing frequent "side heads," followed by concise discussions, the style of this book follows in some measure that introduced by Roger Tory Peterson in his field guide books on nature. Generally, the discussion of each neoplasm follows a set pattern: a short introductory discussion, age and sex incidence, location, roentgenographic appearance when indicated, clinical picture, gross appearance, microscopic appearance, prognosis and treatment. Some of the tumors are also illustrated by characteristic case reports from my own files.

The need for such a book first became apparent to me in 1957 when I was invited to moderate a slide seminar on Childhood Tumors for The California Cancer Commission in Los Angeles. At that time no complete textbook on the subject was available, and articles were sporadic and widely disseminated in numerous specialty journals. During preparations for the seminar it soon became obvious that all available material on childhood tumors should be collected in some suitable form and made available to pathologists and clinicians as a handy and readily accessible reference.

At the conclusion of the conference, held in April, 1958, it was unanimously decided by the pathologists and the pediatricians present that the material presented should be expanded and published as a textbook in order to disseminate more widely our present knowledge of this special field of childhood tumors.

Accordingly, this book has been compiled from the medical literature and the material at the Registry and written with the background of over 27 years experience in the field of pediatric pathology.

The photomicrographs represent tumors in my own personal collection and in that of the Tumor Tissue Registry of the Cancer Commission, California Medical Association, Los Angeles County Hospital.

In writing this book I wish to acknowledge the helpful contributions

of my confreres in the California Society of Pathologists, the Cancer Commission of the California Medical Association, the American Cancer Society, and of Dr. Weldon Bullock, Curator of the Tumor Tissue Registry, and his assistant, Dr. Charles Schwinn, Los Angeles County Hospital.

Carmel, California

PAUL MICHAEL

## Foreword

In 1957 the Cancer Commission of the California Medical Association became decidedly aware that the field of pediatric pathology, especially pediatric neoplasms, was one of growing importance to the medical profession in general, and to pathologists in particular. Accordingly, they chose Tumors of Childhood as the subject for consideration at their semi-annual slide conference. Because of his 27 years' experience in pediatric pathology Paul Michael was asked to moderate this conference, which was held in April 1958 at Los Angeles. He spent many painstaking months in the selection and the presentation of the various types of tumors for the conference. At the conclusion of the day-long seminar the many pathologists and pediatricians present unanimously requested that the presentation be organized and presented in book form for publication.

In expanding the material for publication the author has added many other tumors to those presented at the conference. In addition to the pathologic discussion the book contains clinical, radiologic and therapeutic consideration of the various tumors, and in some cases, clinical histories of many of the patients in his own collection. The book in its present form includes the common tumors of infancy and childhood as well as the rare neoplasms of this age group. The material is well selected and is carefully presented to the reader. The illustrations are numerous and very representative of the various tumors. It is well written, informative, concise and to the point, and is very readable. This book should be of considerable value to pathologists, pediatricians, radiologists and all those interested in diseases of children.

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# 1

## Introduction

A quarter of a century ago deaths due to malignancy in children were statistically insignificant. Today, however, cancer has become second only to trauma as the principal cause of death in children. The explanation for this is both real and relative. Real in the sense that malignant disease has increased both in number and percentage, and relative in that many of the childhood diseases have been controlled successfully by antibiotics, immunizations and other modern therapies. Although theoretically children may be susceptible to the same types of tumors as adults, a great number of childhood tumors are embryonal in nature, and many of them are of complex teratoid structures, indicating conditions of origin that may be considered under the concept of Cohnheim's theory.

Cohnheim's theory was based on the premise that neoplasms resulted from groups of cells, or masses of more complex tissue aggregates that were misplaced during embryonal development; or from cells normally present which had retained their embryonal potentialities. Mixed tumors, both simple and complex, once were considered to be fully explained on the basis of the embryonal theory. When one analyzes the teratoma group, it is apparent that there is an element in common between complex sacral tumors and the more complex parasitic growths, containing portions of organs and extremities. Many congenital tumors, both mesothelial and epithelial, may be present at birth or develop soon after. It is apparent that these tumors are associated with embryologic malformations or disturbances. Congenital cancers affect the kidneys, the eyes, the adrenals, the testes, the ovaries and many other soft-tissue parts. Rudimentary organs are also frequent sites of tumors. Symmetrical tumors sometimes strongly suggest embryonal irregularities, examples of which are nevi, xanthomas, angiomas and myomas.

### INCIDENCE

Some types of childhood cancer occur more frequently in one sex, in

some instances occurring only in one sex, e.g., teratoma of the pineal body in male children. For the most part, however, the general incidence of malignancy in children is essentially equal in both males and females. There are some cancers which may be present at birth, with two later peaks of increased incidence, one occurring at 18 months with a later rise at 5 years. Leukemia deaths are highest during the first four years of life, with a gradual decrease in the 10- to 15-year age group. Deaths from all forms of malignant disease show a decline in the last 4 years of the childhood span, but many benign tumors have an increased incidence during the same period, probably on an endocrine basis.

It is evident to all who study the subject of childhood tumors that there has been a decided increase in deaths from cancer in children up to the age of 15 years. In reviewing the figures from the time of Duzan in 1876 and Picot in 1883 to the present analysis of Dargeon and reports based on vital statistics of the United States, it is apparent that there is not only

TABLE 1. INCIDENCE AND TYPE OF MALIGNANT TUMORS IN 37,000  
AUTOPSIES AT LOS ANGELES COUNTY HOSPITAL (1918-1947)\*

TUMOR	BIRTH TO 1 YEAR	2 TO 10 YEARS
Malignant teratoma	1 (Stillborn)	
Wilm's tumor	1	2
Medullary adrenal tumor	2	1
Myeloid leukemia	1	3
Lymphocytic leukemia	1	9
Leukemia, type unknown		2
Monocytic leukemia		2
Aleukemic leukemia		1
Lymphatic leukemia	2	
Glioma	3	9
Bone sarcoma	1	3
Parotid tumor	1	
Tumor of testis	1	
Lymphosarcoma		5
Reticulum cell sarcoma		1
Cortical tumor		1
Intracranial tumor, type?	1	1
Ependymoma	1	1
Ovarian tumor		1
Retroperitoneal and mesenteric		1
Cranial 5th nerve		1
Myosarcoma of uterus		1
Hodgkin's disease		1

\* Compiled by P. Steiner from Los Angeles County Hospital Files.

an increase in the number of malignant neoplasms, but a change in the predilection of the tumors for different parts of the body. Paul Steiner analyzed 37,000 autopsies performed at the Los Angeles County Hospital during the years 1918 through 1947. In this series he found only 62 malignant tumors in children under the age of 15 years. This represented only 1.2 per cent of all malignant tumors encountered (Table 1). Cancer cases among children, as compiled by the California Tumor Registry and the University of California Hospital in San Francisco, showed a steady rise from 1942 to 1955 (Table 2). In my own series, collected from 1947 to 1957, 259 instances of malignant tumors were encountered (Table 3). There was a marked increase in the incidence of leukemia during this decade, compared with the period between 1936 and 1946, when only 39 cases were admitted for therapy. During this same period there were 11 cases of Ewing's sarcoma compared with 5 in the years 1947 to 1957.

In 1939 the leading causes of death in England and Wales among children in the age group under 15 years included neonatal causes, pneumonia, digestive diseases and congenital malformations. In that year death from cancer was last among the 12 most common causes. In 1953, however, cancer was listed as first among all causes of death in children, excluding accidents.

TABLE 2. CANCER CASES AMONG CHILDREN UNDER 15 YEARS OF AGE  
BY YEAR OF ADMISSION (THROUGH 1955) CALIFORNIA TUMOR  
REGISTRY AND UNIVERSITY OF CALIFORNIA HOSPITAL

YEAR OF ADMISSION	CALIFORNIA TUMOR REGISTRY	UNIVERSITY OF CALIFORNIA HOSPITAL
Total, all cases	1,570	422
Prior to 1942	24	4
1942	57	20
1943	54	23
1944	74	27
1945	67	23
1946	92	28
1947	106	32
1948	100	35
1949	113	31
1950	135	38
1951	115	32
1952	146	28
1953	178	37
1954	172	36
1955	137	28

In 1959, according to figures released by the American Cancer Society, in the United States cancer was the leading cause among all diseases causing death in the childhood age group (Table 4).

The location of different malignant lesions and the histologic types have varied with the years and from clinic to clinic. Helmholz in 1931 reported on 750 malignant tumors seen in the Mayo Clinic (Table 5).

TABLE 3. INCIDENCE AND TYPE OF MALIGNANT  
TUMORS—CHILDREN'S HOSPITAL OF THE  
EAST BAY—1947-1957\*

Leukemia	108
Wilms's tumor	23
Astrocytoma	17
Neuroblastoma	12
Lymphosarcoma	10
Teratoma	8
Fibrosarcoma	8
Medulloblastoma	6
Hodgkin's disease	6
Ewing's sarcoma	5
Reticulum cell sarcoma	3
Ependymoma	3
Malignant melanoma	3
Papillary carcinoma, thyroid	3
Craniopharyngioma	2
Osteogenic sarcoma	2

\* The author's series.

TABLE 4. TEN LEADING CAUSES OF DEATH IN  
CHILDREN 1 TO 14 YEARS OF AGE, U.S., 1959\*

CAUSES	NUMBER OF DEATHS	PER CENT OF TOTAL
All causes	33,546	
1. Accidents	11,402	34.0
2. CANCER	4,138	12.3
3. Congenital malformations	3,257	9.7
4. Pneumonia	3,071	9.2
5. Gastroenteritis	647	1.9
6. Meningitis	546	1.6
7. Heart disease	478	1.4
8. Nephritis	409	1.2
9. Cerebral spastic paralysis	401	1.2
10. Bronchitis	392	1.2

\* Statistical Research Section, Medical Affairs Department, American Cancer Society, New York, New York. Based on Vital Statistics of the United States, 1959.

Dargeon in 1940 listed the various malignancies in children as seen in the Memorial Hospital (Table 6). His latest figures, based on 1,418 malignant tumors from the pediatric service and the children's tumor registry of the Memorial Center, 1926 to 1956, show a decided change in histologic type and location (Table 7). In a still more recent survey (1960) Kiesewetter and Mason reported that in a series of 38,967 admissions to the Children's Hospital in Pittsburgh, 404 patients had malignant tumors—more than 1 per cent of all patients entering the hospital. In their series, renal and adrenosympathetic tumors were the most frequent types,

TABLE 5. STUDY OF 750 MALIGNANT TUMORS (1931)\*

Central nervous system	327
Lymphoid tissues	141
Bone	121
Genitourinary tract	56
Oral	56
Soft somatic tissues	18
Skin	16

\* Helmholz, H. F.: Malignant Neoplasms in Childhood, p. 209, Proc. Interstate Postgraduate Medical Assembly of North America, 1931.

followed by tumors in the lymphoma group. Twelve cases of bone tumors were reported, all in children over 2 years of age.

These figures and tables are cited because they point up certain salient features: there is an increasing interest and awareness of tumors occurring in children, and there is also a changing picture in relation to the types of neoplasms encountered. In most series the mortality rate in malignant disease exceeds 80 per cent, with death occurring usually within 1 year after the diagnosis has been established. In many instances the tumors are incurable from their inception, but in others early diagnosis and the institution of proper therapy will result in permanent cures.

The achievements in diagnosis and therapy have been many and inspiring during the past decade, a tribute to all who are dedicated to the

TABLE 6. MALIGNANT TUMORS (1940)\*

Bone	79
Soft somatic tissues	41
Head and neck	37
Lymphoid tissues	33
Genitourinary	17
Gynecologic system	6
Total tumors	213

\* Data taken from Dargeon, H. W.: Cancer in Childhood, St. Louis, Mosby, 1940.



care and the welfare of children. However, the sum total is indeed small and only of surface depth compared with what lies ahead. It is hoped sincerely that this text will contribute in some manner to the over-all knowledge and understanding of childhood cancer and will be an aid in meeting the challenge which now confronts all those working in the field of pediatrics.

TABLE 7. HISTOLOGIC VARIETIES IN 1,418  
MALIGNANT TUMORS (1956)\*

Lymphomas (including leukemia)	534	(37.6%)
Sarcomas (osseous and somatic)	383	(27.0%)
Carcinomas	105	(7.4%)
Others	396	(28.0%)
Neuroblastomas	171	
Wilms's tumor	93	
Retinoblastoma	57	
Central nervous system	14	
Miscellaneous	61	

\* Dargeon, H. W.: *Tumors of Childhood*, New York, Hoeber, 1960.

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