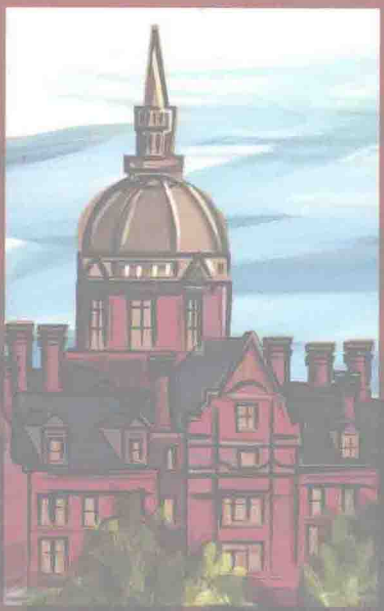
fifteenth
EDITION

THE JOHNS HOPKINS HOSPITAL

THE HARRIET LANE HANDBOOK



GEORGE K. SIBERRY and ROBERT IANNONE

THE HARRIET LANE HANDBOOK

A Manual for Pediatric House Officers

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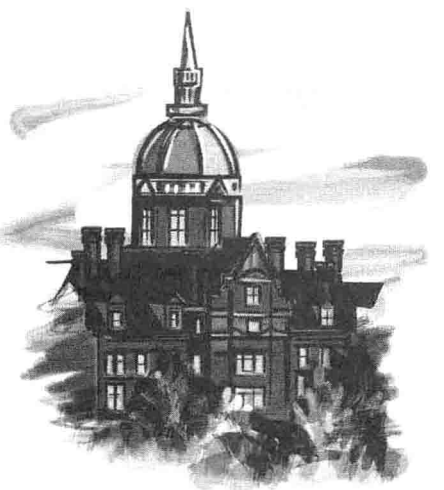

with 151 illustrations and 24 color plates

The Harriet Lane Service
Children's Medical and Surgical Center of
The Johns Hopkins Hospital

EDITORS

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FIFTEENTH EDITION

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To our parents

Patricia K. Siberry and George Siberry, Jr.
For giving me guidance and independence in loving balance

Emma V. Iannone and Matthew M. Iannone (in memoriam)
Their personal sacrifices have privileged me with opportunity that comes from a quality education.

To our families

Uma M. Reddy, Vikram G. Siberry, and Vinod W. Siberry
They make every day special

Peg Iannone
Her enduring support for all of my endeavors brings out the best in me.

To our mentor in pediatrics

Julia A. McMillan

We are grateful to Dr. McMillan as our role model. Her example has inspired us to be both students and teachers of pediatrics. She reminds us that our principal commitment is to our patients, the children whose illnesses we work to cure, whose pain we want to lessen, and whose suffering motivates us to seek better methods.

FOREWORD

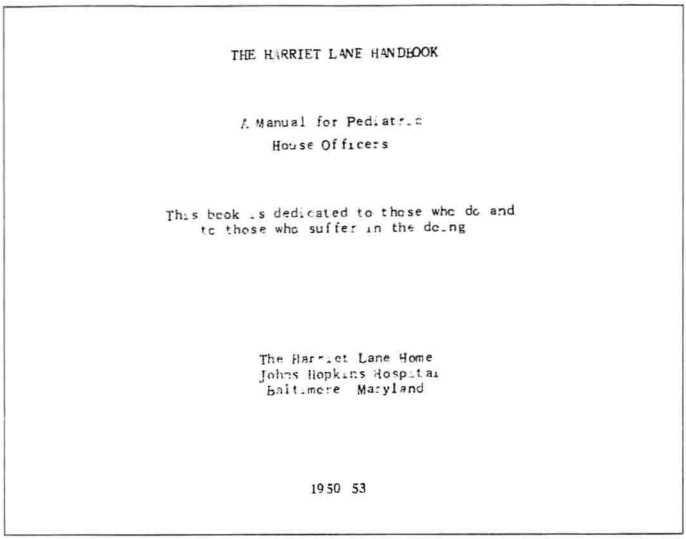
The Harriet Lane Handbook will celebrate its fiftieth year during the printing of the fifteenth edition. Please permit us to share with you a part of our heritage.

A SHORT HISTORY OF HARRIET LANE

Until 1964, The Harriet Lane Home for Invalid Children housed The Department of Pediatrics at Johns Hopkins. Harriet Lane Johnston and her husband Henry Johnston were the donors. Harriet Lane, who was born in Lancaster County, Pennsylvania, lost both of her parents while a child. She was raised with a cousin, also parentless, by their Uncle James Buchanan. Buchanan, a lawyer, was successively a member of the U.S. House of Representatives, a member of the U.S. Senate, Ambassador to Russia, and finally Ambassador to Great Britain. Harriet went to England with her uncle and there is said to have greatly impressed Queen Victoria, who urged her to stay in England and marry into the aristocracy. But in 1857, this possibility had to be tabled because her uncle was elected president of the United States and Harriet returned with him to fulfill the role of first lady. This she did with flair and confidence.

Buchanan's term in office was beset by the turmoil leading up to the War Between The States, and in the end, Abraham Lincoln was elected to replace him. Sadly, he and Harriet retreated to Lancaster, but before many years had passed, she married Henry Johnston, a Baltimore banker. The Johnstons had two children, both boys, and both died as teenagers of rheumatic fever. It was this loss that caused the Johnstons to set aside the money for a children's hospital to be called, at Mr. Johnston's wish, The Harriet Lane Home for Invalid Children. Mr. Johnston died in his fifties, after which Harriet moved back to Washington, the scene of her long ago social triumphs. She died in 1902 at 73, and 10 years later the Harriet Lane Home opened its doors as a part of The Johns Hopkins Hospital.

Barton Childs, MD


THE HARRIET LANE HANDBOOK

A Manual for Pediatric
House Officers

This book is dedicated to those who do and
to those who suffer in the doing

The Harriet Lane Home
Johns Hopkins Hospital
Baltimore Maryland

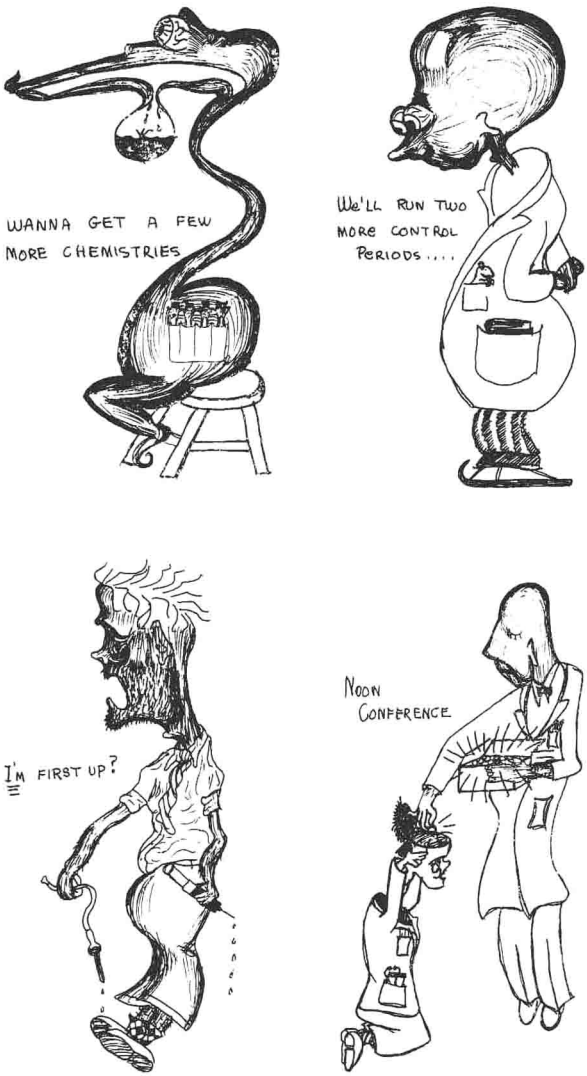
1950 53

Cover of the first *Harriet Lane Handbook*. Dr. Henry Seidel, editor. 1950-1953.

A SHORT HISTORY OF *The Harriet Lane Handbook*

Harrison Spencer, chief resident in 1950-1951, suggested that residents develop a pocket-sized "pearl book." Six of us began without funds and without the supervision of our elders, meeting sporadically around a table in the library of The Harriet Lane Home. We were busy. The work dragged on. The residents changed but not our fervor. Helen Taussig provided diagrams for interpreting fluoroscopy of the heart. Drug doses appeared without substantial pharmacologic advice, developed in large part by rampant empiricism. Rhesa Penn, a resident, drew four marvelous cartoons (see p. ix). Without obvious financial support for mimeographing and looseleafs, our *Handbook* slipped into the pockets of our residents in 1953. Succeeding residents kept revising, updating, improving. Robert Cooke, Department Chief from 1956 to1974, realized the potential, and the fifth edition was published widely by Year Book. Jerry Winkelstein and Herbert Swick led that effort, since, happily, Dr. Cooke kept the residents in charge. *The Handbook* is theirs, and it now fills pockets too numerous to count.

Henry M. Seidel, MD



Original cartoons by Rhesa Penn in the first *Harriet Lane Handbook*. Dr. Henry Seidel, editor. 1950-1953.

It is on this inspiring historical backdrop that other chief residents updated our pediatric practice manual. We are greatly indebted to all the prior editors of *The Harriet Lane Handbook:* Drs. Harrison Spencer, Henry Seidel, Herbert Swick, William Friedman, Robert Haslam, Jerry Winkelstein, Dennis Headings, Kenneth Schuberth, Basil Zitelli, Jeffrey Biller, Andrew Yeager, Cynthia Cole, Mary Greene, Kevin Johnson, and Michael Barone. The current revision process occurs every 3 years. Under the direction of the chief residents, senior residents review, modify, and develop material for each chapter, always with the guidance of our pediatric faculty. Over the years, new chapters have been added when deemed necessary. We are excited to include new sections on surgery, oncology, psychiatry, and biostatistics. We are confident that those who use this manual will greatly benefit from the efforts of these individuals:

Chapter	Resident	Chapter Title	Advisor
1	Michele R. McKee, MD	Emergency Management	Allen R. Walker, MD
2	Sheila M. Hofert, MD	Poisonings	Erica Liebelt, MD Wendy Klein-Schwartz, PhD Cecilia Davoli, MD
3	Wendy Burk Roberts, MD	Procedures	Allen R. Walker, MD
4	Adrianna Maria Bravo, MD	Trauma and Burns	Charles Paidas, MD
5	Diane M. Straub, MD, MPH	Adolescent Medicine	Alain Joffe, MD, MPH
6	Mary K. Choukair, MD	Blood Chemistries/ Body Fluids	John Andrews, MD
7	Lydia Ko Chiang, MD Alison Ensor Dunn, MD	Cardiology	W. Reid Thompson, MD
8	George K. Siberry, MD, MPH	Conversion Formulas and Biostatistics	Harold Lehmann, MD Marie Diener-West, PhD
9	Adrianna Maria Bravo, MD	Development	Peter Blasco, MD
10	Jeffrey Renn Keefer, MD, PhD	Endocrinology	David Cooke, MD
11	Mary K. Choukair, MD	Fluids and Electrolytes	John S. Andrews, MD Fred J. Heldrich, MD Mathuram Santosham, MD
12	B. Kelly Gleason, MD	Gastroenterology	José Saavedra, MD
13	Amy B. Hirshfeld, MD	Genetics	Ada Hamosh, MD
14	George K. Siberry, MD, MPH	Growth Charts	Ada Hamosh, MD
15	Beth E. Ebel, MD, MSc Leslie Raffini, MD	Hematology	James F. Casella, MD
16	Pamela C. Schamber, MD	Immunology	Jerry Winkelstein, MD
17	Beth E. Ebel, MD, MSc Amy B. Hirshfeld, MD	Immunoprophylaxis	Neal A. Halsey, MD
18	Aklil Getachew, MD Beth D. Kaufman, MD	Infectious Diseases	Rodney Willoughby, MD
19	Beth D. Kaufman, MD Aklil Getachew, MD	Microbiology	Julia A. McMillan, MD James Dick, PhD

Continued

Chapter	Resident	Chapter Title	Advisor
20	Diana C. Alexander, MD, MPH Beverley Robin, MD	Neonatology	Estelle B. Gauda, MD
21	Manaji M. Suzuki, MD	Nephrology	Alicia Neu, MD
22	Jessica Sessions, MD	Neurology	Rebecca N. Ichord, MD
23	Jeanne Cox, MS, RD	Nutrition	José Saavedra, MD
24	David A. Jacobsohn, MD	Oncology	Alan Friedman, MD
25	R. Skyler McCurley, MD	Pulmonology	Gerald Loughlin, MD
26	Geetha Subramaniam, MD Jessica Sessions, MD	Psychiatry Encountered Conditions	Mark Riddle, MD Emily Frosch, MD
27	Pamela C. Schamber, MD	Radiology	Jane Benson, MD Bennett B. Chin, MD
28	Karen E. Lantz, MD	Surgery	Walter Pegoli, MD
29	Amy B. Hirshfeld, MD Aklil Getachew, MD Jessica Sessions, MD	Drug Doses	Carlton K.K. Lee, PharmD, MPH
30	Beverley Robin, MD	Analgesia and Sedation	Myron Yaster, MD
31	Diana C. Alexander, MD, MPH	Special Drug Topics	Carlton K.K. Lee, PharmD, MPH
32	Manaji M. Suzuki, MD	Drugs in Renal Failure	Carlton K.K. Lee, PharmD, MPH

For many, the formulary is the most often referenced section. Credit for this concise, yet comprehensive pediatric dosage resource is owed in large part to Carlton K.K. Lee, PharmD. The reader will notice substantial changes in the fomulary. Modern typesetting has allowed us to use the portrait layout to list brand names, standard preparations, dosage, and important remarks. We have also added important information on safety in breast-feeding, pregnancy, and renal failure, flagging these drugs with easily recognizable icons.

We would also like to thank the many other persons who contributed their expertise to the fifteenth edition: Jeanne Cox, MS, RD, for her work on the nutrition section; Dr. William Zinkham for providing the hematology color plates; and Josie Pirro, RN, for providing the illustrations in Chapter 3 (Procedures). We thank the following faculty who reviewed specific sections of chapters in areas of their expertise: Drs. Barbara Fivush (hypertension), Claude Migeon (steroids), Allen Chen (chemotherapy), Bernard Cohen (acne), Judy Vogelhut (breastfeeding), Beryl Rosenstein (cystic fibrosis), Leslie Plotnick (DKA), Charles Paidas (pediatric surgery), Dave Rodeberg (pediatric surgery), Steve Docimo (pediatric urology), Russell Faust (pediatric otolaryngology), John Graybeal, DDS (dentistry/oral surgery), Paul Sponseller (pediatric orthopedics), and Laura Sterni (pulmonary). The artwork at the section headings is the work of the late Aaron Sopher, whose timeless illustrations of the Harriet Lane Home were made some 30 years ago.

Please allow us also to thank those with whom we have worked daily over the past year and whose support we could not have done without:

Kenneth Judd, Francine Cheese, Kathy Miller, and Leslie Burke. We would like to give special thanks to Monica Casella, who coordinated our collective efforts in putting the manuscript together.
We would especially like to thank Dr. George Dover, Chairman of the Department of Pediatrics at Johns Hopkins. Dr. Dover has supported us in all aspects of our job as chief residents, especially in issues related to Harriet Lane residents and resident life.

Finally, thanks to all of the residents. Learning from you and assisting in your professional growth has been the most enjoyable part of our jobs.

Assistant Residents	Interns
Gail Addlestone	Sanjay Aggarwal
Henry "Kip" Baggett	Hans Agrawal
Elizabeth Cristofalo	Kamal Bharucha
David Fleischer	Patrick Brown
Ruchira Garg	Colleen Clendenin
Julia Arana	Angela Ellison
Lisa Gesualdo	Dana Erikson
Jeffrey Gossett	Jeffrey Fadrowski
Veronica Gunn	Michael Fields
Alex Huang	Allison Koenig
Paul Law	Karen Lewis
Anuj "Steve" Narang	Manisha Makker
Christian Nechyba	Deborah McWilliams
Declan O'Riordan	Namrata Pai
Tyler Reimschisel	Hardin Pantle
Mark Rigby	Genevieve Parsons
Brian Sard	Stacie Peddy
Susan Scherer	Kristina Powell
Julie Snell	Erica Reed
Jennifer Tucker	Kerry VanVoorhis
Sandhya Vasan	Tong-Yi Yao
Anne-Lise Yohay	
Kaleb Yohay	

George K. Siberry
Robert Iannone

ABBREVIATIONS

A-a	alveolar-arterial
ABG	arterial blood gas
ACE	angiotensin converting enzyme
ACTH	adrenocorticotropic hormone
ADH	antidiuretic hormone
AD(H)D	attention deficit (hyperactivity) disorder
AFP	alpha fetoprotein
AGA	average (weight) for gestational age
AIDS	acquired immunodeficiency syndrome
ALL	acute lymphocytic leukemia
ALT	alanine aminotransferase
ALTE	apparent life-threatening event
AML	acute myelocytic leukemia
ANC	absolute neutrophil count
AP	anteroposterior
aPTT	activated partial thromboplastin time
ASD	atrial septal defect
ASO	antistreptolysin O
AST	aspartate aminotransferase
AXR	abdominal x-ray
BAER	brainstem auditory evoked responses
BCG	bacille Calmette-Guérin
BID	*bis in die* (twice a day)
BMI	body mass index
BP	blood pressure
BPD	bronchopulmonary dysplasia
BSA	body surface area
BUN	blood urea nitrogen
BVH	biventricular hypertrophy
BW	birthweight
CBC	complete blood count
CDC	Centers for Disease Control and Prevention
CGD	chronic granulomatous disease
CHF	congestive heart failure
CHO	carbohydrate
CLD	chronic lung disease
CMV	cytomegalovirus
CNS	central nervous system
CO	carbon monoxide
CO_2	carbon dioxide
CP	cerebral palsy
CPAP	continuous positive airway pressure
Cr	creatinine
CRP	C-reactive protein
CSF	cerebrospinal fluid
CT	computed tomography
CXR	chest x-ray
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
DMSA	dimercaptosuccinic acid
DPL	diagnostic peritoneal lavage
DQ	developmental quotient
DSM-IV	*Diagnostic and Statistical Manual-IV*
DTaP	diphtheria–tetanus–acellular pertussis
DTP	diphtheria-tetanus-pertussis
DTR	deep tendon reflex
DVT	deep vein thrombosis
EBV	Epstein-Barr virus
ECF	extracellular fluid
ECG	electrocardiogram
ECMO	extracorporeal membrane oxygenation
EEG	electroencephalogram
ELISA	enzyme-linked immunosorbent assay
ESR	erythrocyte sedimentation rate
ETT	endotracheal tube
FDP	fibrin degradation products
FFP	fresh frozen plasma
FISH	fluorescent in situ hybridization
FTT	failure to thrive
FW	free water
GBS	group B streptococcus; Guillain-Barré syndrome
GER(D)	gastroesophageal reflux (disease)
GFR	glomerular filtration rate
GI	gastrointestinal
HBIG	hepatitis B immune globulin
HBV	hepatitis B virus
HCG, β-HCG	human chorionic gonadotropin
Hct	hematocrit
Hib	*Haemophilus influenzae* type b
HIE	hypoxic-ischemic encephalopathy
HIV	human immunodeficiency virus
HSP	Henoch-Schönlein purpura
HSV	herpes simplex virus
HUS	hemolytic-uremic syndrome
IBD	inflammatory bowel disease
ICF	intracellular fluid
ICP	intracranial pressure
Ig	immunoglobulin
IM	intramuscular(ly)
IMV	intermittent mandatory ventilation
INH	isoniazid
IO	intraosseous(ly)
IPV	inactivated polio virus vaccine
ITP	idiopathic thrombocytopenic purpura
IUGR	intrauterine growth retardation
IV	intravenous(ly)
IVC	inferior vena cava
IVH	intraventricular hemorrhage
IVIG	intravenous immune globulin

IVP	intravenous pyelogram
JRA	juvenile rheumatoid arthritis
LAE	left atrial enlargement
LBBB	left bundle branch block
LFT	liver function tests
LGA	large (weight) for gestational age
LSD	lysergic acid diethylamide
LV	left ventricle
LVH	left ventricular hypertrophy
LVOT	left ventricular outflow tract
MAOI	monoamine oxidase inhibitor
MAP	mean arterial pressure; mean airway pressure
MBC	mean bactericidal concentration
MCV	mean corpuscular volume
MIC	mean inhibitory concentration
MMR	measles–mumps–rubella
MMSE	Mini-Mental State Examination
MR	mental retardation; mitral regurgitation
MRI	magnetic resonance imaging
MS	mitral stenosis; multiple sclerosis
MV	mitral valve
NEC	necrotizing enterocolitis
NG	nasogastric
NPO	*nil per os* (nothing by mouth)
NSAID	nonsteroidal antiinflammatory drug
OCP	oral contraceptive pill
OGTT	oral glucose tolerance test
OPV	oral polio virus vaccine
ORS	oral rehydration solution
ORT	oral rehydration therapy
PA	posteroanterior; pulmonary artery
PAC	premature atrial contraction
PCA	patient-controlled analgesia
PCP	*Pneumocystis carinii* pneumonia; phenylcyclohexyl piperidine or phencyclidine
PCR	polymerase chain reaction
PD	peritoneal dialysis
PDA	patent ductus arteriosus
PEEP	positive end-expiratory pressure
PEFR	peak expiratory flow rate
PEG	percutaneous endoscopic gastrostomy
PEM	protein energy malnutrition
PFT	pulmonary function tests
PID	pelvic inflammatory disease
PIP	peak inspiratory pressure
PMN	polymorphonuclear leukocyte
PO	*per os* (by mouth)
PR	per rectum
PRP	phosphylribosopyro-phosphate
PS	pulmonic stenosis
PT	prothrombin time
PTT	*See* aPTT
PTH	parathyroid hormone
PV	pulmonic valve
PVC	premature ventricular contraction
QD	*quaque die* (every day)
QID	*quater in die* (four times a day)
RAE	right atrial enlargement
RBBB	right bundle branch block
RBC	red blood cell
RDA	recommended dietary allowance
RDS	respiratory distress syndrome
RDW	red cell distribution width
RF	rheumatoid factor
ROP	retinopathy of prematurity
RPR	rapid plasma reagin
RSV	respiratory syncytial virus
RTA	renal tubular acidosis
RV	right ventricle
RVH	right ventricular hypertrophy
RVOT	right ventricular outflow tract
SBE	subacute bacterial endocarditis
SC	subcutaneous(ly)
SGA	small (weight) for gestational age
SIDS	sudden infant death syndrome
SSRI	selective serotonin reuptake inhibitor
STD	sexually transmitted disease
STS	serologic test for syphilis
SVC	superior vena cava
SVT	supraventricular tachycardia
TB	tuberculosis
TCA	tricyclic antidepressant
TGA	transposition of the great arteries
TID	*ter in die* (three times a day)
TSH	thyroid-stimulating hormone
TTP	thrombotic thrombocytopenic purpura
TV	tricuspid valve
UA	urinalysis
UAC	umbilical artery catheter
UGI	upper gastrointestinal (series)
UTI	urinary tract infection
UVC	umbilical vein catheter
VBG	venous blood gas
VCUG	voiding cystourethrogram
VDRL	Veneral Disease Research Laboratory
VSD	ventricular septal defect
VUR	vesicoureteral reflux
VZIG	varicella-zoster immune globulin
VZV	varicella-zoster virus
WB	Western blot
WPW	Wolff–Parkinson–White

CONTENTS

THE HARRIET LANE HANDBOOK

A Manual for Pediatric House Officers

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EMERGENCY MANAGEMENT

Michele R. McKee, MD

I. AIRWAY

A. ASSESSMENT

1. **Open airway:** Establish open airway with head-tilt/chin-lift maneuver. If neck injury is suspected, jaw-thrust should be used.
2. **Obstruction:** Rule out foreign body, anatomic or other obstruction.

B. MANAGEMENT

1. **Equipment**

a. Oral airway
   1) Poorly tolerated in conscious patient.
   2) Size: With flange at teeth, tip reaches angle of jaw.
   3) Length ranges from 4–10cm.

b. Nasopharyngeal airway
   1) Relatively well tolerated in conscious patient. Rarely provokes vomiting or laryngospasm.
   2) Size: Length = tip of nose to angle of jaw.
   3) Diameter: 12–36 French.

2. **Intubation:** Sedation and paralysis recommended unless patient is unconscious or a newborn.

a. Indications: Obstruction (functional or anatomic), prolonged ventilatory assistance or control, respiratory insufficiency, loss of protective airway reflexes, or route for approved medications.

b. Equipment (See table on inside front cover.)
   1) Endotracheal tube (ETT): Size = (Age + 16)/4 = Internal diameter. Uncuffed ETT in patients <8 years old. Depth of insertion (in cm; at the teeth or lips) is approximately 3 × ETT size.
   2) Laryngoscope blade: Generally, a straight blade can be used in all patients. A curved blade may be easier in patients >2 years old.
   3) Bag and mask attached to 100% oxygen.
   4) ETT stylets: Not to extend beyond the distal end of the ETT.
   5) Suction: Large-bore (Yankauer) suction catheter or 14–18 French suction catheter.
   6) Nasogastric (or orogastric) tube: Size from nose to angle of jaw to xyphoid process.
   7) Monitoring equipment: For electrocardiogram (ECG), pulse oximetry, blood pressure.

c. Procedure
   1) Preoxygenate with 100% O_2 via bag and mask.
   2) Administer intubation medications (Table 1.1 and Fig. 1.1).
   3) Ask assistant to apply cricoid pressure to prevent aspiration (Sellick maneuver).
   4) With patient lying supine on a firm surface, head midline and slightly extended, open mouth with right thumb and index finger.