

# Contents

List of Abbreviations .....	10	4.3.1 Symptoms of Lung Diseases .....	43
<b>1. Introduction .....</b>	<b>11</b>	4.3.2 Changes in the Hila and Pulmonary Vasculature .....	48
1.1 Origin and Properties of X-rays .....	11	4.3.3 Changes in the Diaphragm and Diaphragm Angles .....	49
1.2 Biological Effects of X-rays .....	11	4.3.4 Changes in the Heart and Mediastinum ...	49
1.3 Principles of Radiation Protection .....	11	4.3.5 Changes in the Skeleton of the Thorax.....	52
1.4 Overview of Doses in Radiological Examinations.....	12	4.3.6 The Main Differences in Radiographs Taken of a Standing or Supine Patient.....	52
1.5 Request for Radiological Examination .....	13	4.4 Evaluation and Examination Report.....	53
1.6 Radiological Report.....	13	4.4.1 Radiograph.....	53
<b>2. Imaging Methods.....</b>	<b>14</b>	4.4.2 CT.....	53
2.1 Radiography .....	14	4.5 Pulmonary Inflammation .....	54
2.2 Fluoroscopy .....	15	4.5.1 Pneumonia, Bronchopneumonia.....	54
2.3 Tomography, Tomosynthesis.....	16	4.5.2 Atypical Pneumonia, Mycotic and Parasitic Lung Disease.....	54
2.4 Angiography.....	16	4.5.3 Complications of pulmonary inflammation .....	56
2.5 Ultrasonography (US).....	17	4.5.4 Pulmonary Tuberculosis .....	58
2.6 Computed Tomography (CT).....	21	4.5.5 Chronic Obstructive Pulmonary Disease.....	59
2.7 Magnetic Resonance (MR).....	25	4.6 Diffuse Interstitial Lung Disease.....	59
2.7.1 Magnetic Resonance Imaging (MRI) .....	26	4.6.1 Pneumoconioses .....	60
2.7.2 Magnetic Resonance Angiography (MRA).....	29	4.6.2 Sarcoidosis.....	61
2.7.3 Magnetic Resonance Spectroscopy (MRS) .....	30	4.6.3 Hypersensitivity Pneumonitis (HP) .....	62
2.7.4 Functional Magnetic Resonance Imaging (fMRI).....	30	4.6.4 Pulmonary Fibrosis.....	62
2.7.5 Other Types of MR Examinations .....	31	4.7 Tumours of the Lungs and Bronchi.....	64
2.8 Picture Archiving and Communication Systems – PACS.....	32	4.7.1 Bronchogenic Carcinoma .....	64
<b>3. Contrast Media .....</b>	<b>33</b>	4.7.2 Metastases in the Lungs.....	65
3.1 Positive CM .....	33	4.7.3 Intra-thoracic Lymphomas and Leukaemia.....	67
3.1.1 Barium CM .....	33	4.7.4 Benign Lung Tumours.....	68
3.1.2 Iodine CM .....	33	4.8 Pulmonary Circulatory Disorders.....	68
3.2 Negative CM.....	35	4.8.1 Congenital Anomalies.....	68
3.3 Double Contrast Examination.....	35	4.8.2 Pulmonary Embolism.....	68
3.4 Contrast Media for Ultrasonography.....	35	4.8.3 Pre-capillary Pulmonary Hypertension ...	68
3.5 Magnetic Resonance Contrast Media .....	36	4.8.4 Pulmonary Oedema (Post-capillary Pulmonary Hypertension) .....	69
<b>4. Thorax .....</b>	<b>37</b>	4.9 The Heart .....	71
4.1 Imaging Anatomy.....	37	4.9.1 Congenital Malformations.....	71
4.2 Imaging Methods.....	40	4.9.2 Heart Failure .....	71
4.2.1 Chest Radiograph.....	40	4.9.3 Diseases of Valves.....	71
4.2.2 Computed Tomography (CT).....	40	4.9.4 Bacterial Endocarditis .....	71
4.2.3 Angiographic Methods.....	42	4.9.5 Myxoma and Other Intra-cardial Expansions .....	71
4.2.4 Ultrasonography.....	42	4.9.6 Ischaemic Heart Disease, Myocardial Infarction.....	72
4.2.5 Magnetic Resonance.....	42	4.9.7 Hypertension .....	72
4.2.6 Nuclear Medicine Methods .....	43	4.9.8 Pericardial Disease .....	72
4.2.7 Intervention Radiology Methods.....	43	4.10 Diseases of the Mediastinum .....	72
4.2.8 Other Imaging Methods.....	43	4.10.1 Expansion in the Mediastinum .....	72
4.3 General Signs of Pathological Changes .....	43	4.10.2 Mediastinitis .....	73

4.11 Pleural Diseases .....	73	6.2.3 Computed Tomography (CT).....	118
4.11.1 Pleural Fluid .....	73	6.2.4 Magnetic Resonance.....	120
4.11.2 Pneumothorax.....	75	6.2.5 Interventional Radiology Methods.....	120
4.11.3 Pleural Thickening.....	75	6.2.6 Radiograph.....	121
4.11.4 Pleural Tumours .....	75	6.3 General Signs of Pathological Changes of the Gastrointestinal Tract in an Examination with CM.....	121
4.12 Chest Injuries .....	75	6.4 Assessment and Examination Report .....	122
<b>5. Musculoskeletal System .....</b>	<b>79</b>	6.4.1 Examination with Contrast Media .....	122
5.1 Imaging Anatomy.....	79	6.4.2 Ultrasonography.....	123
5.2 Imaging Methods.....	82	6.4.3 CT/MR.....	123
5.2.1 Radiography.....	82	6.5 Diseases of the Pharynx and Oesophagus.....	123
5.2.2 Computed Tomography .....	82	6.5.1 Inflammation of the Oesophagus.....	123
5.2.3 Ultrasonography .....	82	6.5.2 Retropharyngeal Abscess .....	124
5.2.4 Magnetic Resonance.....	83	6.5.3 Oesophageal manifestations of the systemic autoimmune diseases.....	124
5.2.5 Nuclear Medicine Methods .....	83	6.5.4 Hypopharyngeal Tumours.....	124
5.2.6 Arthrography.....	83	6.5.5 Oesophageal Tumours.....	124
5.2.7 Densitometry.....	83	6.5.6 Diverticula of the Oesophagus.....	125
5.2.8 Interventional Radiology Methods.....	83	6.5.7 Achalasia .....	126
5.3 General Signs of Pathological Changes .....	83	6.5.8 Gastro-Oesophageal Varices.....	126
5.3.1 Symptoms of Skeletal Affection.....	83	6.5.9 Oesophageal Perforation.....	126
5.3.2 Symptoms of Soft Tissue Disorders .....	85	6.6 Stomach and Duodenal Disorders .....	126
5.4 Evaluation and Examination Report.....	87	6.6.1 Inflammatory Diseases of the Stomach and Duodenum .....	126
5.4.1 Radiographs.....	87	6.6.2 Tumours of the Stomach and Duodenum .....	128
5.4.2 Other Imaging Methods.....	87	6.6.3 Hiatus Hernia .....	129
5.5 Injuries .....	87	6.6.4 Blunt Duodenal Injury .....	130
5.5.1 Bones.....	87	6.6.5 Duodenal Diverticula.....	130
5.5.2 Joints .....	91	6.7 Small Bowel Disease.....	131
5.5.3 Soft Tissues of Joints .....	92	6.7.1 Inflammatory Diseases of the Small Bowel .....	131
5.5.4 Muscles and Tendons.....	94	6.7.2 Malabsorption Syndrome .....	132
5.6 Degenerative Joint Diseases – Osteoarthritis.....	94	6.7.3 Tumours of the Small Bowel.....	132
5.7 Bone and Joint Inflammations.....	95	6.7.4 Meckel's Diverticulum .....	132
5.7.1 Bone Inflammation – Osteomyelitis.....	95	6.8 Diseases of the Colon.....	132
5.7.2 Joint Inflammations – Arthritis.....	96	6.8.1 Inflammatory Diseases of the Colon.....	132
5.8 Bone Tumours.....	100	6.8.2 Tumours of the Large Bowel.....	134
5.8.1 Osteogenic Tumours.....	102	6.8.3 Colonic Diverticulosis.....	136
5.8.2 Chondrogenic Tumours .....	102	6.8.4 Anorectal Dysfunctions .....	137
5.8.3 Osteoclastoma (Giant Cell Tumour) .....	103	6.9 Evaluation of Post-operative Conditions of the Gastrointestinal Tract.....	137
5.8.4 Bone-Marrow Tumours.....	103		
5.8.5 Vascular Tumours .....	104		
5.8.6 Secondary Bone Tumours (Metastases)..	104		
5.8.7 Bone Pseudotumours.....	104		
5.9 Tumours of Soft Tissues.....	108		
5.9.1 Benign Tumours.....	108		
5.9.2 Malignant Tumours .....	108		
5.10 Other Osteopathies.....	108		
5.10.1 Circulation Disorders.....	108		
5.10.2 Metabolic and Hormonal Osteopathies .....	109		
5.10.3 Other Bone Diseases.....	111		
<b>6. Gastrointestinal Tract (GIT).....</b>	<b>112</b>	<b>7. Liver, Bile Ducts, Pancreas, and Spleen .....</b>	<b>139</b>
6.1 Imaging Anatomy.....	112	7.1 Liver.....	139
6.2 Imaging Methods.....	114	7.1.1 Imaging Methods .....	139
6.2.1 Examinations Using Contrast Media .....	115	7.1.2 Hepatic Steatosis.....	140
6.2.2 Ultrasonography.....	117	7.1.3 Cirrhosis.....	140
		7.1.4 Portal Hypertension.....	141
		7.1.5 Liver Cysts.....	141
		7.1.6 Liver Abscess .....	141
		7.1.7 Liver Tumours .....	142
		7.1.8 Injuries.....	143
		7.2 Gallbladder and Bile Ducts .....	145

7.2.1 Imaging Methods .....	145	9.17 Adrenal Diseases .....	173
7.2.2 Cholecystolithiasis .....	146	9.18 Other Retroperitoneal Diseases .....	175
7.2.3 Choledocholithiasis .....	147		
7.2.4 Cholecystitis.....	147	<b>10. Neuroradiology – Brain, Skull.....</b>	<b>176</b>
7.2.5 Cholangitis.....	148	10.1 Imaging Anatomy.....	176
7.2.6 Tumours .....	148	10.2 Imaging Methods .....	178
7.2.7 Icterus.....	148	10.2.1 Computed Tomography.....	179
7.2.8 Postoperative Complications.....	149	10.2.2 Magnetic Resonance .....	179
7.3 Pancreas .....	149	10.2.3 Angiography.....	179
7.3.1 Imaging Methods.....	149	10.2.4 Ultrasonography.....	179
7.3.2 Acute Pancreatitis.....	149	10.2.5 Radiography.....	179
7.3.3 Chronic Pancreatitis .....	150	10.3 General Signs of Pathological Changes.....	179
7.3.4 Tumours of the Pancreas.....	150	10.3.1 Symptoms of Brain Pathology .....	179
7.4 Spleen .....	151	10.3.2 Symptoms of Pathologies of Spaces Filled with Cerebrospinal Fluid (CSF) .....	180
7.4.1 Imaging Methods.....	151	10.3.3 Symptoms of Pathology of the Cerebral Meninges .....	181
7.4.2 Splenomegaly.....	151	10.3.4 Symptoms of Vascular Impairment.....	182
7.4.3 Expansion.....	151	10.4 Assessment and Examination Report.....	182
7.4.4 Injuries.....	152	10.5 Congenital Varieties and Anomalies .....	182
		10.6 Head and Brain Trauma .....	183
<b>8. Abdominal Trauma and Acute Abdomen .....</b>	<b>153</b>	10.6.1 Skeletal Injury .....	184
8.1 Abdominal Trauma .....	153	10.6.2 Brain Injuries.....	184
8.2 Acute Abdomen .....	153	10.6.3 Extracerebral Traumatic Haemorrhage .....	186
8.2.1 Inflammatory Acute Abdomen .....	154	10.6.4 Other Traumatic Intracranial Changes.....	187
8.2.2 Bowel Obstruction and Ileus.....	155	10.7 Stroke .....	188
8.2.3 Bleeding.....	158	10.7.1 Ischaemic Stroke .....	188
		10.7.2 Haemorrhagic Stroke .....	189
<b>9. Urinary System, Sex Organs in Men, Retroperitoneum .....</b>	<b>160</b>	10.8 Tumours.....	191
9.1 Imaging Anatomy.....	160	10.9 Inflammations.....	194
9.2 Imaging Methods.....	162	10.10 Diseases of the White Matter .....	195
9.2.1 Ultrasonography.....	162	10.11 Diseases of Cerebral Vessels.....	195
9.2.2 Computed Tomography .....	163	10.12 Degenerative Diseases of the Brain .....	197
9.2.3 Radiography.....	163		
9.2.4 Intravenous Urography (IVU).....	163	<b>11. Neuroradiology – Spine, Spinal Cord.....</b>	<b>199</b>
9.2.5 Voiding Cystourethrography.....	163	11.1 Imaging Anatomy.....	199
9.2.6 Digital Subtraction Angiography, Interventional Radiology .....	163	11.2 Imaging Methods .....	201
9.2.8 Magnetic Resonance.....	163	11.2.1 Radiography.....	201
9.3 Evaluation and Examination Report.....	163	11.2.2 Computed Tomography.....	201
9.4 Congenital Anomalies and Variants .....	164	11.2.3 Magnetic Resonance .....	202
9.5 Acquired Anomalies of Kidney Position .....	165	11.3 General Signs of Pathological Changes.....	202
9.6 Urolithiasis.....	166	11.3.1 Symptoms of Skeletal Pathology.....	202
9.7 Obstructive Uropathy .....	166	11.3.2 Signs of Intervertebral Discs Pathology .....	202
9.8 Renal masses.....	167	11.3.3 Symptoms of Spinal Canal and Its Content Pathology.....	202
9.9 Tumours of the Renal Pelvis, Ureter, and Urinary Bladder .....	170	11.4 Evaluation and Examination Report .....	205
9.10 Acute Inflammatory Diseases of the Kidney ...	170	11.5 Congenital Variations and Anomalies.....	205
9.11 Chronic Inflammatory Diseases of the Kidney and Urinary Tract.....	170	11.6 Trauma of the Spine and Spinal Cord .....	206
9.12 Urinary Tract Trauma.....	172	11.7 Tumours.....	208
9.13 Renovascular Hypertension.....	172	11.8 Degenerative Diseases .....	210
9.14 Transplanted Kidney.....	172	11.9 Inflammatory Diseases .....	214
9.15 Prostate Disease.....	173		
9.16 Diseases of the Testicles and Epididymis .....	173		

<b>12. Head and Neck Radiology .....</b>	<b>215</b>		
12.1 Imaging Anatomy.....	215		
12.2 Imaging Methods .....	218		
12.2.1 Ultrasonography.....	218		
12.2.2 Computed Tomography.....	218		
12.2.3 Magnetic Resonance .....	219		
12.2.4 Radiography.....	219		
12.2.5 Contrast Examination.....	219		
12.2.6 Interventional Methods.....	219		
12.2.7 Nuclear Medicine Methods.....	219		
12.3 Evaluation and Examination Report .....	219		
12.4 Thyroid Gland, Parathyroid Glands.....	220		
12.5 Cervical Lymphadenopathy.....	221		
12.6 Other Expansions in the Neck.....	221		
12.7 Tumours of the Maxillofacial Region .....	222		
12.8 Larynx, Pharynx.....	222		
12.9 Paranasal Sinuses.....	224		
12.10 Temporal Bone.....	225		
12.11 Large Salivary Glands.....	226		
12.12 Orbits.....	227		
12.13 Facial Injuries .....	228		
<b>13. Breast Imaging .....</b>	<b>230</b>		
13.1 Imaging Anatomy.....	230		
13.2 Imaging Methods .....	231		
13.2.1 Mammography (MG) .....	231		
13.2.2 Ultrasonography (US).....	231		
13.2.3 Magnetic Resonance .....	231		
13.2.4 Ductography.....	232		
13.2.5 Nuclear Medicine Methods.....	232		
13.2.6 Biopsy.....	232		
13.3 General Signs of Pathological Changes .....	234		
13.4 Evaluation and Examination Report .....	234		
13.5 Inflammatory Diseases of the Breast .....	235		
13.6 Benign Breast Lesions.....	236		
13.7 Malignant Breast Tumours.....	236		
<b>14. Radiodiagnostics in Gynaecology and Obstetrics.....</b>	<b>239</b>		
14.1 Imaging Anatomy.....	239		
14.2 Imaging Methods .....	240		
14.3 Evaluation and Examination Report .....	241		
14.4 Imaging during Pregnancy.....	241		
14.5 Imaging in the Evaluation of Infertility.....	243		
14.6 Inflammations of the Uterus and Adnexa, Endometriosis.....	243		
14.7 Cystic and Tumourous Affections of the Uterus and Adnexa .....	243		
<b>15. Arterial System.....</b>	<b>245</b>		
15.1 Imaging Anatomy.....	245		
15.2 Imaging Methods .....	248		
15.2.1 Digital Subtraction Angiography (DSA) .....	248		
15.2.2 Doppler Ultrasonography .....	250		
15.2.3 CT Angiography (CTA).....	251		
15.2.4 MR Angiography (MRA) .....	253		
15.2.5 Radiograph.....	254		
15.3 General Signs of Pathological Changes .....	255		
15.3.1 Pathological Findings in Arteriography (DSA, CTA, and MRA).....	255		
15.3.2 Pathological Findings in US.....	259		
15.4 Evaluation and Examination Report .....	259		
15.5 Pathological Conditions of the Aortic Arch and Arteries of the Head (Brain and Face) and Neck.....	260		
15.5.1 Pathological Conditions of the Aortic Arch.....	260		
15.5.2 Pathological Conditions of the Arteries of the Neck and Face.....	260		
15.5.3 Pathological Conditions of the Intracranial Vasculature .....	261		
15.5.4 Detection of Brain Death .....	261		
15.6 Pathological Conditions of Upper Extremity Arteries .....	262		
15.7 Pathological Conditions of the Heart and Coronary Arteries .....	262		
15.7.1 Pathological Conditions of the Heart ...	262		
15.7.2 Pathological Conditions of Coronary Arteries .....	263		
15.8 Pathological Conditions of the Thoracic Aorta and Medullary and Spinal Arteries .....	263		
15.9 Pathological Conditions of Splanchnic Arteries .....	263		
15.10 Pathological Conditions of Renal Arteries....	264		
15.11 Pathological Conditions of the Abdominal Aorta, Pelvic, and Lower Extremity Arteries.....	264		
15.12 Pathological Conditions of the Pulmonary Arteries.....	265		
<b>16. Venous System .....</b>	<b>266</b>		
16.1 Imaging Anatomy.....	266		
16.2 Imaging Methods .....	268		
16.2.1 Doppler Ultrasonography .....	268		
16.2.2 Venography (Phlebography) .....	268		
16.2.3 CT Venography and MR Venography ..	269		
16.2.4 Radiograph.....	270		
16.3 General Signs of Pathological Changes .....	270		
16.3.1 Pathological Findings in US.....	270		
16.3.2 Pathological Findings in Venography...	271		
16.4 Evaluation and Examination Report .....	271		
16.5 Venous Thrombosis.....	271		
16.6 Occlusion of the Superior or Inferior Vena Cava.....	271		
16.7 Examination of the Venous System of the Upper Extremities before the Implantation of a Dialysis Shunt .....	271		
16.8 Portal Hypertension.....	272		

<b>17. Lymphatic System</b> .....	<b>273</b>	<b>18.5 Transjugular Intrahepatic Portosystemic Shunt (TIPS)</b> .....	<b>291</b>
17.1 Imaging Anatomy.....	273	Non-Vascular Interventions.....	291
17.2 Imaging Methods.....	274	18.6 Percutaneous Biopsy.....	291
17.2.1 Ultrasonography.....	274	18.7 Percutaneous Aspiration and Drainage of Fluid Collections and Abscesses.....	292
17.2.2 Computed Tomography.....	274	18.8 Radiofrequency Ablation.....	293
17.2.3 Magnetic Resonance.....	274	18.9 Interventions in the Biliary Tract.....	293
17.2.4 Nuclear Medicine Methods.....	274	18.9.1 Percutaneous Transhepatic Drainage of the Biliary Tract (PTD).....	293
17.3 Evaluation and Examination Report.....	274	18.9.2 Dilation of Stenoses of the Biliary Tract.....	294
17.4 Lymphadenopathy.....	274	18.9.3 Percutaneous Extraction of Stones from the Biliary Tract.....	294
17.5 Lymphocele.....	276	18.10 GIT Interventions.....	294
<b>18. Interventional Radiology</b> .....	<b>277</b>	18.10.1 Dilatation of GIT Stenoses.....	294
Vascular Interventions.....	277	18.10.2 Palliative Treatment of Dysphagia with Stents.....	295
18.1 Recanalization Interventions.....	277	18.10.3 Percutaneous Gastrostomy.....	295
18.1.1 Percutaneous Transluminal Angioplasty (PTA).....	277	18.11 Percutaneous Nephrostomy.....	296
18.1.2 Subintimal Angioplasty.....	279	18.12 Respiratory Interventions.....	296
18.1.3 Stents in the Vascular System.....	280	<b>19. Paediatric Radiology</b> .....	<b>297</b>
18.1.4 Local Thrombolysis.....	282	19.1 Respiratory Tract.....	297
18.1.5 Mechanical Thrombectomy.....	282	19.1.1 Pulmonary Diseases.....	297
18.2 Reconstruction Interventions.....	282	19.1.2 Mediastinal Diseases.....	298
18.2.1 Endovascular Treatment of Arterial Aneurysms, Pseudoaneurysms, and Arteriovenous Fistulas with Stent Grafts.....	282	19.1.3 Heart Disease.....	298
18.3 Transcatheter Embolization Methods.....	284	19.2 Gastrointestinal Tract.....	298
18.3.1 Chemotherapy and Chemoembolization of Liver Metastases.....	285	19.2.1 Diseases of the Gastrointestinal Tract.....	299
18.3.2 Preoperative Embolization of the Portal Vein.....	285	19.3 Urogenital Tract.....	300
18.3.3 Embolization of Acute Bleeding into the GIT.....	287	19.3.1 Diseases of the Kidneys and the Urinary Tract.....	302
18.3.4 Endovascular Treatment of Haemobilia.....	287	19.4 Musculoskeletal System.....	304
18.3.5 Endovascular Treatment of Vascular Trauma.....	287	19.4.1 Diseases of the Skeleton.....	304
18.3.6 Sclerotherapy of Peripheral Vascular Malformations.....	288	19.5 Neuroradiology.....	306
18.3.7 Endovascular Embolization Methods in Neuroradiology.....	289	19.5.1 Diseases of the Brain.....	307
18.4 Inferior Vena Cava Filters.....	290	19.5.2 Diseases of the Spine.....	308
		<b>Index</b> .....	<b>310</b>