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The IRMA code for unique classification of medical images

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ABSTRACT

Modern communication standards such as Digital Imaging and Communication in Medicine (DICOM) include non-image data for a standardized description of study, patient, or technical parameters. However, these tags are rather roughly structured, ambiguous, and often optional. In this paper, we present a mono-hierarchical multi-axial classification code for medical images and emphasize its advantages for content-based image retrieval in medical applications (IRMA). Our so called IRMA coding system consists of four axes with three to four positions, each in $\{0,...,9,a,...,z\}$, where "0" denotes "unspecified" to determine the end of a path along an axis. In particular, the technical code (T) describes the imaging modality; the directional code (D) models body orientations; the anatomical code (A) refers to the body region examined; and the biological code (B) describes the biological system examined. Hence, the entire code results in a character string of not more than 13 characters (IRMA: TTTT – DDD – AAA – BBB). The code can be easily extended by introducing characters in certain code positions, e.g., if new modalities are introduced. In contrast to other approaches, mixtures of one- and two-literal code positions are avoided which simplifies automatic code processing. Furthermore, the IRMA code obviates ambiguities resulting from overlapping code elements within the same level. Although this code was originally designed to be used in the IRMA project, other use of it is welcome.

Keywords: Standardized Nomenclature, Digital Imaging and Communication in Medicine (DICOM), Picture Archiving and Communication Systems (PACS), Content-Based Image Retrieval (CBIR), Image Classification Code

1. INTRODUCTION

Modern communication standards include non-image data for a standardized description of study, patient, body region examined, and technical parameters related to the imaging modality in use. In order to provide comprehensive, detailed coverage for multi-specialty biomedical imaging, the College of American Pathologists (CAP), secretariat of the Systematized Nomenclature of Human and Veterinary Medicine (SNOMED), has entered into partnership with the Digital Imaging and Communications in Medicine (DICOM) Standards Committee and other professional organizations to develop a nomenclature that is needed for diagnostic imaging applications [1]. The SNOMED DICOM microglossary was developed to provide context-dependent value sets for DICOM coded-entry data elements, and semantic content specifications for reports and other structures composed of multiple data elements [2].

Although the capability of storing explicitly-labeled coded descriptors in DICOM images and reports improves the potential for selective retrieval of images and related information, the controlled terminology within the DICOM tables has been found to be insufficiently detailed for order entry systems [3] or even invalid, if values are set automatically by the system [4]. Concerning the needs for content-based image retrieval in medical applications (IRMA), a detailed coding scheme is required to describe (a) the imaging modality including technical parameters, (b) the orientation of the image with respect to the body, (c) the body region examined, and (d) the biological system investigated [5,6].

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In this paper, we present a mono-hierarchical (i.e., every son-node is connected to only one parent-node) multi-axial (i.e., more tan one semantic axes) classification code for medical images [7] in English and emphasize its advantages for image retrieval in comparison to existing proposals supplementary to the DICOM standard.

2. METHODS

Within the IRMA system [5], categorization is the first of seven successive analyzing steps extracting content information from medical images. The categorization aims to establish intelligent processing strategies adapted to the current image under investigation. Therefore, valid relations between code and sub-code elements are "is-a" and "part-of" only. Consequently, the code must be strictly hierarchical in order to support semantic queries on a database. Furthermore, causality is important for grouping of processing strategies. Therefore, a mono-hierarchical scheme is required, where each sub-code element is connected to only one code element. Since categorization of medical images must cover all aspects influencing the image content and structure, a multi-axial scheme was designed. This scheme, which has been presented previously in German [7] is now available in English, as well.

3. RESULTS

The IRMA coding system consists of four axes with three to four positions, each in {0,...9,a,...,z}, where "0" denotes "unspecified" to determine the end of a path along an axis:

- T (technical): image modality
- D (directional): body orientation
- A (anatomical): body region examined
- B (biological): biological system examined

This allows a short and unambiguous notation (IRMA: TTTT – DDD – AAA – BBB), where T, D, A, and B denotes a coding or sub-coding digit of the technical, directional, anatomical, and biological axis, respectively. In addition, this notation avoids mixtures of one- and two-literal code positions.

3.1. Technical code for imaging modality

The T-code describes within a maximum of four positions the technical method. It starts with the physical source of image acquisition (e.g.: 1 "x-ray", 2 "ultrasound", 3 "magnetic resonance imaging", 4 "optical imaging", ...) showing more details in the modality position (e.g.: 11 "plain film projection radiography", 12 "fluoroscopy", 13 "angiography", 14 "computed tomography", ...). A third digit specifies the technique (e.g.: 111 "digital", 112 "analog", 113 "stereometry", 114 "stereography", ...), and the fourth position of the T-code assesses sub-techniques (e.g.: 1111 "tomography", 1112 "high energy", 1113 "low energy", 1114 "parallel beam", ...). A complete listing of the IRMA T-code is given in Appendix A. Note that the non-radiological part of this code (4 "nuclear medicine", 5 "optical imaging", 6 "biophysical procedures", 7 "others", 8 "secondary digitization") are not modeled completely.

3.2. Directional code for imaging orientation

This three-digit part of the IRMA-code incorporates a two-step orientation description starting with the common orientation (e.g.: 1 "coronal", 2 "sagittal", 3 "transversal", 4 "other") and giving a more detailed specification in the second position (e.g.: 11 "posteroanterior (PA)", 12 "anteroposterior (AP)"). Note that it is important to distinguish AP-and PA-directions since organs and bone structures might differ in scale, for instance, supposing plain x-ray chest imaging. Independent from the relative orientation of body region and imaging system, functional orientation tasks of the examination can also be described (e.g.: 111 "inspiration", 112 "expiration", 113, "valsalva", 114 "phonation", ...). A complete listing of the IRMA D-code is given in Appendix B.

3.3. Anatomical code for body region examined

The IRMA-code supports complete coding of the anatomical region. In total, nine major regions are defined (e.g.: 1 "total body", 2 "head/scull", 3 "spine", 4 "upper extremity", ...). The major region is followed by up to two

hierarchical sub-codes (e.g.: 3 "spine", 31 "cervical spine", 311 "dens"). A complete listing of the IRMA A-code is given in Appendix C.

3.4. Biological code for biological system examined

The B-code determines the organ system that is imaged. This axis is necessary because the body region examined insufficiently describes content and structure of images. For example, fluoroscopy of the abdominal region may access the vascular or the gastrointestinal system depending on the way the contrast agent is administered, which results in different image textures. On the top-level of this three digit IRMA-code, ten organ systems are specified (e.g.: 1 "cerebrospinal system", 2 "cardiovascular system", 3 "respiratory system", 4 "gastrointestinal system", ...) each of which having up to three positions to exactly identify the organ in question (e.g.: 1 "cerebrospinal system", 11 "central nervous system", 111 "mesencephalon"). A complete listing of the IRMA B-code is given in Appendix D.

3.5. Examples of image coding

A web-based interface has been established for coding of radiographs [8]. All images are converted to readable icons of about 200 x 200 pixels and labeled with the appropriate code by two professional readers, i.e. board certified radiologists. This allowed the assessment of the quality of computerized image categorization and also to create a gold standard. The labeling tool is based on an relational database addressed with standard query language (postgreSQL 7.1.3), an interface to a web-server (apache 1.3.26 with built-in php 4.2.2 interpreter) and on the client-site on a standard internet browser (mozilla 1.1). The appropriate code is entered and remarks of the readers are collected. The code can be entered directly into the appropriate field, if known by heart, or composed - making extensive use of javascripting in the HTML-file to enable modifying pop-up menus according to the decision made at higher levels. This resulted in a stepwise refinement of the code. The radiological report is available simultaneously to judge for specific comments. Thereafter, coded images are transferred anonymously from the routine application into the IRMA research case database [8].

Figure 1 gives two examples of unambiguous image classification using the IRMA-code. The image on the left is coded: "x-ray, projection radiography, analog, high energy – sagittal, left lateral decubitus, inspiration – chest, lung – respiratory sytem, lung. The image on the right is coded: x-ray, fluoroscopy, analog – coronad, ap, supine – abdomen, upper abdomen, middle – gastrointestinal system, stomach".

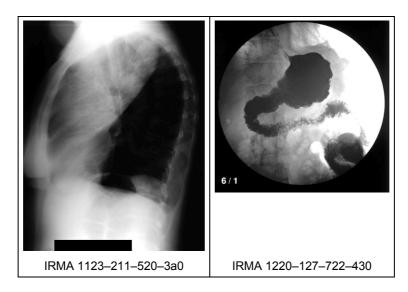


Figure 1: IRMA-coded chest and abdomen radiograph.

4. DISCUSSION

A basic requirement for coding medical images according to processing within a system for content-based retrieval is the mono-hierarchical structure of the code. Although several nomenclatures exist, these are neither causal, hierarchical, complete, nor unambiguous. For instance, valid instances for the DICOM tag "body part examined" are "skull", "cspine", "tspine", "sspine", "cspine", "chest", "clavicle", "breast", "abdomen", "pelvis", "hip", "shoulder", "elbow", "knee", "ankle", "hand", "foot", "extremity", "head", "heart", "neck", "arm", "jaw", and "special" [9]. Note the different grade of differentiation (e.g., "cspine", "tspine", "sspine" vs. "skull"), the incompleteness (e.g., "arm" but not "leg"), and the ambiguities (e.g., "extremity" vs. "arm" or "hand").

The MeSH thesaurus is a poly-hierarchical structure where entities can be reached on different paths [10]. For instance, the IRMA T-code 1111 "dual energy digital plain x-ray" corresponds to the 2002 MeSH codes E01.370.350.700.700, E01.370.350.760.700, and E01.370.350.600.350.700.700 for "radiography, dual energy scanned projection". Furthermore, the MeSH thesaurus is not sufficiently detailed in all of the IRMA axis, especially for the T-axis.

Although it was demonstrated that SNOMED [11] is the most complete reference terminology in existence today for the clinical environment [12], its incompleteness with respect to technical usage for image retrieval reveals a major disadvantage of SNOMED when compared to the IRMA code. For instance, the SNOMED DICOM microglossary offers "breast" but not "mammary gland" [3].

In summary, the IRMA coding scheme is closest related to the JJ1017 code [3]. Likewise the JJ1017 approach, the IRMA code enables image classification with respect to technical, directional, anatomical, and biological criterions. In contrast to JJ1017, IRMA is more detailed, offers four instead of three separated axes for the four parameters described above, and is strictly mono-hierarchical in each axis. In addition, ambiguities of JJ1017 are avoided. For instance, JJ1017 offers "chest", "chest/abdomen", and "abdomen" on the first level of its "large region code" and hence, it is not suitable for content-based image retrieval in medical applications.

Based on its structure, the IRMA code can easily be extended (adding new characters to a certain code position) and refined. For instance, the IRMA B-code 411 "oral cavity" for the biological system imaged can be further specified if required for other usage than content-based image retrieval, e.g., 4110 "unspecified", 4111 "tongue" 4112 "floor of mouth", 4113 "hard palate", 4114 "soft palate", 4115 "cheek".

So far, the coding support was easy to use in about 6,000 single images, the loading time for the small images (about 200 pixels either direction) was short, the support of the javascripts in case of unknown combinations of the coding scheme was helpful. It turned out that rarely (less than 0.1 %) the regional code is too limited to describe the body parts depicted on a radiograph. This is especially true for long extremity overviews. The extremity codes allows only a very general or a highly specific localization of a combination of two nearby regions [8].

5. CONCLUSION

A mono-hierarchical multi-axial code scheme is presented that enables a unique classification of medical images. The entire code results in a character string of not more than 13 characters. The code can be easily extended by introducing characters in certain code positions, e.g., if new modalities are introduced. In contrast to other approaches, mixtures of one- and two-literal code positions are avoided which simplifies automatic code processing. Furthermore, the IRMA code steers clear of ambiguities resulting from overlapping code elements within the same level. Although this code was originally designed to be used in the IRMA project, other use is welcome.

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APPENDIX

1112 tomography A Technical code for imaging modality 1113 high beam energy Note that the non-radiological part of this code 1114 low beam energy (4 "nuclear medicine", 5 "optical imaging", 6 "biophysical procedures", 7 "others", 8 "secondary far view projection 1115 1116 1:1 projection digitization") are not modeled completely. 1117 dual energy 112 analog 1120 unspecified unspecified 0 1121 overview image 1 x-ray 1122 tomography 10 unspecified high beam energy 1123 plain radiography 11 1124 low beam energy 110 unspecified 1125 far view projection 111 digital 1:1 projection 1126 1110 unspecified 113 x-ray stereometry 1111 overview image 114 x-ray stereography

	115	tomosynthesis				2215 variable frequency
10	116	xeroradiography			222	linear scan
12	fluoro					2220 unspecified
	120	unspecified				2221 3.5 MHz
	121	digital				2222 5.0 MHz
12	122	analog				2223 7.5 MHz
13		graphy				2224 10 MHz
	130 131	unspecified		23	M-mo	2225 variable frequency
	131	digital 1310 unspecified		23	230	unspecified
		1311 subtraction (DSA)			230	3.5 MHz
		1312 rotation			232	5.0 MHz
		angiography			233	7.5 MHz
		1313 pathfinder			234	10 MHz
		technique			235	variable frequency
	132	analog		24		ound mode
		1320 unspecified			240	unspecified
		1321 photo subtraction			241	3.5 MHz
14	compu	ated tomography (CT)			242	5.0 MHz
	140	unspecified			243	7.5 MHz
	141	conventional CT			244	10 MHz
		1410 unspecified			245	variable frequency
		1411 low dose		25		ape mode
		1412 high resolution			250	unspecified
		bolus tracking			251	3.5 MHz
	142	quantitative CT			252	5.0 MHz
		1420 unspecified			253	7.5 MHz
	DEM	1421 dual energy			254	10 MHz
15		A (quantitative radiography)		26	255	variable frequency
	150 151	unspecified		26	-	x mode
	131	digital 1510 unspecified			260 261	unspecified 3.5 MHz
		1510 dual energy			262	5.0 MHz
16	radiot	herapy			263	7.5 MHz
10	160	unspecified			264	10 MHz
	161	digital			265	variable frequency
	162	analog		27		er mode
sonogr					270	unspecified
	unspe	cified			271	3.5 MHz
21	A-mo				272	5.0 MHz
	210	unspecified			273	7.5 MHz
	221	3.5 MHz			274	10 MHz
	212	5.0 MHz			275	variable frequency
	213	7.5 MHz		28	3D im	C C
	214	10 MHz			280	unspecified
	215	variable frequency			281	3.5 MHz
22	B-mod				282	5.0 MHz
	220	unspecified			283	7.5 MHz
	221	sector scan			284	10 MHz
		2210 unspecified	2		285	variable frequency
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	3111	endo coil			144	head coil
	3112	body		3	145	neck coil
	3113	body array		3	146	spine coil
	3114	head coil		3	147	loop coil
	3115	neck coil		3	148	shoulder coil
	3116	spine coil		3	149	knee coil
	3117	loop coil		3	14a	hand / small FOV
	3118	shoulder coil		3	14b	mamma coil
	3119	knee coil		3	14c	flexible coil, large
	311a	hand / small FOV		3	14d	flexible coil, small
	311b	mamma coil		3	14e	endorectal coil
	311c	flexible coil, large		3	14f	wrap around coil
	311d	flexible coil, small	31	5 C	ine-Lo	olo
	311e	endorectal coil		3	150	unspecified
	311f	wrap around coil		3	151	endo coil
312	T2-we	ighted		3	152	body
	3120	unspecified		3	153	body array
	3121	endo coil		3	154	head coil
	3122	body		3	155	neck coil
	3123	body array		3	156	spine coil
	3124	head coil			157	loop coil
	3125	neck coil			158	shoulder coil
	3126	spine coil			159	knee coil
	3127	loop coil			15a	hand / small FOV
	3128	shoulder coil			15b	mamma coil
	3129	knee coil			15c	flexible coil, large
	312a	hand / small FOV			15d	flexible coil, small
	312b	mamma coil			15e	endorectal coil
	312c	flexible coil, large			15f	wrap around coil
	312d	flexible coil, small	31			on recovery
	312e	endorectal coil			160	unspecified
	312f	wrap around coil			161	endo coil
313		-weighted			162	body
	3130	unspecified			163	body array
	3131	endo coil			164	head coil
	3132	body			165	neck coil
	3133	body array			166	spine coil
	3134	head coil			167	loop coil
	3135	neck coil			168	shoulder coil
	3136	spine coil			169	knee coil
	3137	loop coil			16a	hand / small FOV
	3138	shoulder coil			16b	mamma coil
	3139	knee coil			16c	flexible coil, large
	313a	hand / small FOV			16d	flexible coil, small
	313b	mamma coil			16e	endorectal coil
	313c	flexible coil, large			16f	wrap around coil
	313d	flexible coil, small	31		LARE	•
	313e	endorectal coil			170	unspecified
	313f	wrap around coil			171	endo coil
314		pression			172	body
	3140	unspecified			173	body array
	3141	endo coil			174	head coil
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			318e	endorectal coil			111	inspiration
			318f	wrap around coil			112	expiration
	32	spectro		wap would con			113	valsalva
4		medicir					114	phonation
	40	unspec					115	upright
	41		lation pro	be			116	sitting
	42		a camera				117	supine
	43		photon er	mission			118	prone
		compu	ited tomo	graphy (SPECT)			119	lateral decubitus
	44	positro	n emissio	on tomography (PET)			11a	flexion, left
5	optical	imaging					11b	flexion, right
	50	unspec	eified				11c	swallow
	51	endosc					11d	micturition
	52	micros					11e	bending
	53	photog				12		posterior (AP, coronal)
	54	fundus					120	unspecified
	55		urface sca	an			121	inspiration
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44 bregmaticooccipital 45 submentobregmatical 46 submentobregmaticofrontal 47 bregmaticooral 48 bregmaticosubmental 49 right anterior oblique (RAO) 4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) C Anatomical code for body region examined 340 unspecified 341 lumbo-sacral conjunction 35 coccygeal bone 40 unspecified 41 hand 41 hand 410 unspecified 411 finger 412 middle hand 413 carpal bones							34		
45 submentobregmatical 46 submentobregmaticofrontal 47 bregmaticooral 48 bregmaticosubmental 49 right anterior oblique (RAO) 4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) C Anatomical code for body region examined 341 lumbo-sacral conjunction 35 coccygeal bone 4 upper extremity / arm 40 unspecified 41 hand 410 unspecified 411 finger 412 middle hand 413 carpal bones							54		
46 submentobregmaticofrontal 47 bregmaticooral 48 bregmaticosubmental 49 right anterior oblique (RAO) 4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) C Anatomical code for body region examined 35 coccygeal bone 4 upper extremity / arm 40 unspecified 41 hand 410 unspecified 411 finger 412 middle hand 413 carpal bones									
47 bregmaticooral 48 bregmaticosubmental 49 right anterior oblique (RAO) 4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) C Anatomical code for body region examined 4 upper extremity / arm 40 unspecified 41 hand 410 unspecified 411 finger 412 middle hand 413 carpal bones							35		
48 bregmaticosubmental 49 right anterior oblique (RAO) 4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) C Anatomical code for body region examined 40 unspecified 41 hand 410 unspecified 411 finger 412 middle hand 413 carpal bones					4	4			
49 right anterior oblique (RAO) 4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) C Anatomical code for body region examined 41 hand 410 unspecified 411 finger 412 middle hand 413 carpal bones								•	
4a left anterior oblique (LAO) 5 RSA / ap and lateral (simultaneously) 410 unspecified 411 finger 412 middle hand 413 carpal bones									
5 RSA / ap and lateral (simultaneously) 411 finger 412 middle hand 413 carpal bones									unspecified
C Anatomical code for body region examined 412 middle hand carpal bones	5								-
Anatomical code for body region examined 413 carpal bones			•						
1	C	Anatomica	i code f	for body region examined					
	0	unspeci	fied				42	radio ca	

	43	forearn	1	8	pelvis		
		430	unspecified		80	unspec	ified
		431	distal forearm		81	sarcral	bone
		432	proximal forearm			810	unspecified
	44	elbow	r			811	iliosacral-junction
	45	upper a	ırm		82	iliac bo	
	10	450	unspecified		83	pubic b	
		451	distal upper arm		03	830	unspecified
		452	proximal upper arm			831	symphysis
	46	should			84	small p	
	40	460	unspecified		04	840	unspecified
		461	scapula			841	sacral bone
		462	humero-scapular joint			842	ischial bone
		463		9	lower		
5	chest	403	acromio-scapula joint	9	90	xtremity	
)		1100000	ified			unspec	ined
	50	unspec	illed		91	foot	
	51	bones	: C: - 1			910	unspecified
		510	unspecified			911	toe
		511	clavicle			912	middle foot
		512	sternoclavicle region			913	tarsal bones
		513	sternum		92	ankle jo	
		514	upper ribs		93	lower l	
		515	lower ribs			930	unspecified
	52	lung				931	distal lower leg
		520	unspecified			932	proximal lower leg
		521	upper lobe		94	knee	
		522	middle lobe			940	unspecified
		523	lower lobe			941	patella
	53	hilum			95	upper l	eg
	54	medias	tinum			950	unspecified
		540	unspecified			951	distal upper leg
		541	anterior mediastinum			952	proximal upper leg
		542	middle mediastinum		96	hip	
		543	posterior mediastinum		D. 1 . 1	1 0	
	55	heart	-	D	Biological	code for	· system examined
	56	diaphra	ıgm	0	unspeci	ified	
5		mamma)		1		spinal sy	rstem
7	abdome				10	unspec	
	70	unspec	ified		11		nervous system
	71		ıbdomen			110	unspecified
		710	unspecified			111	metencephalon, cerebrum
		711	upper right quadrant			112	mesencephalon,
		712	upper middle quadrant			112	diencephalon
		713	upper left quadrant			113	neurohypophysis,
	72		abdomen			113	posterior pituitary gland
	12	720	unspecified			114	cerebellum
		721	middle right abdomen			115	pons
		722	peri navel region			116	medulla oblongata
		723	middle left quadrant				_
	73		ibdomen			117	spinal cord, cervical
	15	730				118	spinal cord, thoracic
			unspecified			119	spinal cord, lumbal
		731	lower right quadrant			11a	spinal cord, sacral
		732	lower middle quadrant		10		(cauda equina)
		733	lower left quadrant	1	12	sense o	rgans

		120	unspecified		34	mesoph	arvnx
		121	vestibular sense		35	hypoph	
		122	hearing sense		36	larynx	ui y ii A
		123	gustatory sense		37	trachea	
		123	tactile sense		38	main br	eon ahua
		125	vision sense		39	bronchi	
	1.0	126	olfactory sense		3a	lung	
	13		ive nervous system		3b	pleura	
		130	unspecified		3c	ribs	
		131	sympathic chain		3d	diaphra	
		132	glomus jugulare		3e		stal muscles
		133	glomus caroticum	4		ntestinal s	
		134	ganglion stellatum		40	unspect	
		135	ganglion coeliacum		41	orophai	rynx
		136	organ of Zuckerkandl			410	unspecified
		137	adrenal medulla			411	oral cavity
2	cardiova	ascular s	ystem			412	epipharynx
	20	unspeci				413	mesopharynx
	21	heart				414	hypopharynx
		210	unspecified		42	esophag	
		211	pericardium			420	unspecified
		212	atrium			421	upper esophagus sphincter
		213	mitral valve			422	upper third
		214	tricuspidal valve			423	middle third
		215	ventricle			424	lower third
		216	aortic valve			424	
		217			12		lower esophagus sphincter
	22		pulmonary valve		43	stomacl	
	22	arteries	: C - 1			430	unspecified
		220	unspecified			431	cardia
		221	ascending aorta			432	fundus
		222	aortic arche			433	corpus
		223	brachiocephalic trunk			434	antrum
		224	common carotic artery			435	pylorus
		225	botalli ligament &		44	small in	
			ductus arteriosus			440	unspecified
		226	descending aorta			441	duodenum
		227	bronchial trunk			442	jejunum
		228	abdominal aorta			443	ileum
		229	celiac trunk			444	terminal ileum
		22a	common iliac artery			445	ileoceocal valve
		22b	other arteries		45	large in	testine
	23	veins				450	unspecified
		230	unspecified			451	ascending colon
		231	anonymus vein			452	transverse colon
		232	brachiocephalic vein			453	descending colon
		233	superior vena cava			454	sigmoid colon
		234	inferior vena cava			455	rectum
		235	common iliac vein		46	append	
		236	other veins		47	anus	ix.
3	recnirot	ory syste			48	liver	
ی	30	unspeci			70	480	unspecified
	31	-	IICu				-
		nose				481	parenchyma
	32	sinuses	0- min1- min-			482	bile ducts
	33	nasopha	arynx & epipharynx	l		483	portal vein

		484	arteries
		485	veins
	49	biliary s	
	47	490	=
		490 491	unspecified bile ducts
		491	
	1-		gallbladder
	4a	salivary	_
		4a0	unspecified
		4a1	parotic gland
		4a2	sublingual gland
		4a3	mandibular gland
_		4a4	pancreas
5		tic syster	
	50	unspeci	fied
	51	kidney	
		510	unspecified
		511	parenchyma
		512	renal pelvis
	52	ureter	
	53		bladder
	54	urethra	
6	-	ctive sys	
	60	unspeci	
	61	male sy	
		610	unspecified
		611	testes
		612	deferent duct &
			seminal vesicle
		613	prostate gland
		614	penis
			(incl. corpus cavernosum)
	62	female	system
		620	unspecified
		621	ovaries
		622	tuba uterina
		623	uterus
		624	vagina
		625	breast
7	musculo	osceletal	system
8	endocri	nic syste	m
	80	unspeci	fied
	81	thyroid	gland
	82	parathy	roid gland
	83	adrenal	gland
	84	pituitar	
	85	hypotha	
	86	ovaries	
	87	testes	
	88	pancrea	ıs
9		c system	
	90	unspeci	
	91	tonsils	
	92		lymph node
	93		lymph node
)	J F

94	mediastinal lymph node
95	thymus
96	spleen
97	retroperitoneal lymph node
98	intraperitoneal lymph node
	980 unspecified
	981 mesenterial lymph node
99	iliac lymph node
9a	inguinal lymph node
9b	bone marrow
derm	al system