

DICOM Correction Item

Correction Number		CP-981
Log Summary: Arterial Spin Labeling attributes for Enhanced MR Images		
Type of Modification	Name of Standard	
Addition	PS 3.3, 3.6 – 2009	
Rationale for Correction		
<p>There is a clinical and interoperability need for a standardized way of conveying Arterial Spin Labeling information in Enhanced MR images.</p> <p>The proposed solution provides attributes for sorting the frames (through the dimension module), attributes to describe the labeling technique, as well as regional anatomical information for the identification of the labeling slabs.</p>		
Sections of documents affected		
PS 3.3 Section A.36.2.4, C.8.13.3.1.1.3, C.8.13.3.1.1.4, C.8.13.4 and C.8.13.5		
PS 3.6 Section 6		
Correction Wording:		

Item #1: Amend PS 3.3 Table A.36-2 to add ASL Functional group Macro

A.36.2.4 Enhanced MR Image Functional Group Macros

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**Table A.36-2
ENHANCED MR IMAGE FUNCTIONAL GROUP MACROS**

Functional Group Macro	Section	Usage
...		
MR Velocity Encoding	C.8.13.5.13	C – Required if Phase Contrast (0018,9014) equals YES and Image Type (0008,0008) Value 1 is ORIGINAL or MIXED. May be present otherwise.
<u>MR Arterial Spin Labeling</u>	<u>C.8.13.5.xx</u>	<u>C–Required if Image Type (0008,0008) Value 3 is ASL. May be present otherwise.</u>

Item #2: Amend PS 3.3 update Table C.8-83 and C.8- 84 to add ASL Image Type Terms for values 3 and 4:

C.8.13.3.1.1.3 Image Flavor

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Table C.8-83
MR-SPECIFIC IMAGE TYPE AND FRAME TYPE VALUE 3

Defined Term Name	Defined Term Description
ANGIO_TIME	Angio time acquisition (peripheral vascular/carotid)
<u>ASL</u>	<u>Arterial Spin Labeling</u>
...	

C.8.13.3.1.1.4 Derived Pixel Contrast

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Table C.8-84
MR-SPECIFIC IMAGE TYPE AND FRAME TYPE VALUE 4

Defined Term Name	Defined Term Description
ADC	Apparent Diffusion Coefficient
<u>PERFUSION ASL</u>	<u>Perfusion from an ASL series obtained by subtraction of control and label data</u>
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Item #3: Amend PS 3.3 Table C.8-87 to add ASL Contrast

C.8.13.4 MR Pulse Sequence Module

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Table C.8-87
MR PULSE SEQUENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
...			
Time of Flight Contrast	(0018,9015)	1C	Time of Flight contrast is created by the inflow of blood in the saturated plane. Enumerated Values: YES NO Required if Image Type (0008,0008) Value 1 is ORIGINAL or MIXED. May be present otherwise.
<u>Arterial Spin Labeling Contrast</u>	<u>(0018,9250)</u>	<u>1C</u>	<u>Arterial Spin Labeling contrast technique.</u> <u>Enumerated Values:</u> <u>CONTINUOUS = a single long low powered RF pulse</u>

			<p><u>PSEUDOCONTINUOUS = multiple short low powered RF pulses</u> <u>PULSED = a single short high powered RF pulse</u> <u>Required if Image Type (0008,0008)</u> <u>Value 3 is ASL. May be present otherwise.</u></p>
...			

Item #4: Amend PS 3.3 to section C.8.13.5 for the ASL Functional Group:

C.8.13.5.xx MR Arterial Spin Labeling Macro

Table C.8-xxx specifies the attributes of the MR Arterial Spin Labeling Functional Group macro.

**Table C.8-xxx
MR ARTERIAL SPIN LABELING MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
MR Arterial Spin Labeling Sequence	(0018,9251)	1	A sequence that provides the position of Arterial Spin Labeling regions deposited as part of the pulse sequence. One or more items may be included in this sequence.
>ASL Technique Description	(0018,9252)	2	Text describing the used labeling technique in more detail.
>ASL Context	(0018,9257)	1C	The purpose of the Arterial Spin Labeling. Enumerated Values: LABEL CONTROL M_ZERO_SCAN Required if Frame Type (0008,9007) is ORIGINAL. May be present otherwise. See C.8.13.5.xx.1 for further explanation.
> ASL Slab Sequence	(0018,9260)	1C	Sequence describing the ASL Slab geometry and anatomical region Required if ASL Context (0018,9257) is CONTROL or LABEL. May be present otherwise. One or more Items shall be included in this sequence.
>>ASL Slab Number	(0018,9253)	1	Consecutive number identifying the different slabs used for labeling, starting with 1.
>>Include 'General Anatomy Optional Macro' Table 10-7			The anatomical region where the slab is positioned. Defined Context ID for the Anatomic Region Sequence (0008,2218) is CID 4030. Defined Context ID for Anatomic Region Modifier Sequence (0008,2220) and Primary Anatomic Structure Modifier Sequence (0008,2230) is CID 2.

>>ASL Slab Thickness	(0018,9254)	1	Thickness of slab in mm.
>>ASL Slab Orientation	(0018,9255)	1	The direction cosines of a normal vector perpendicular to the ASL slab with respect to the patient. See C.7.6.2.1.1 for further explanation.
>>ASL Mid Slab Position	(0018,9256)	1	The x, y, and z coordinates of the midpoint of the slab in mm with respect to the patient. See C.7.6.2.1.1 for further explanation.
>>ASL Pulse Train Duration	(0018,9258)	1	Duration (in milliseconds) of the Label or Control pulse. See C.8.13.5.xx.3 for further explanation.
>ASL Crusher Flag	(0018,9259)	1	Indicates if an ASL Crusher Method has been used. Enumerated Values: YES NO See C.8.13.5.xx.2 for further explanation.
>ASL Crusher Flow Limit	(0018,925A)	1C	Maximum Flow Limit (in cm/s). Required if ASL Crusher Flag (0018,9259) is YES.
>ASL Crusher Description	(0018,925B)	1C	Description of the ASL Crusher Method. Required if ASL Crusher Flag (0018,9259) is YES.
>ASL Bolus Cut-off Flag	(0018,925C)	1	Indicates if a Bolus Cut-off technique is used. Enumerated Values: YES NO
>ASL Bolus Cut-off Timing Sequence	(0018,925D)	1C	Sequence that specifies the timing of the Bolus Cut-off technique and possibly its (scientific) description. One item may be included in this sequence. Required if ASL Bolus Cut-off Flag (0018,925C) is YES.
>>ASL Bolus Cut-off Delay Time	(0018,925F)	1	Bolus Cut-off pulse delay time (in ms). See C.8.13.5.xx.3 for further explanation.
>>ASL Bolus Cut-off Technique	(0018,925E)	2	Text describing the cut-off technique.

C.8.13.5.xx.1 ASL Context

The attribute ASL Context (0018,9257) categorize the Original ASL images according to three contexts. This categorization allows post processing applications to select the correct type of image.

LABEL: Images are acquired with magnetically labeled arterial blood supply.

CONTROL: Images are acquired with a 'control' pulse in the proximal vessels.

M_ZERO_SCAN: Images are acquired with no label or control pulse in the proximal vessels.

C.8.13.5.xx.2 ASL Crusher Flag

In order to quantify the perfusion accurately, it may be necessary to suppress signals within the macroscopic blood vessels (crushing). This can be used to separate the arterial input function from the brain parenchymal signal. The ASL Crusher Flag (0018,9259) indicates the application of an ASL crushing technique.

Note: Frames with and without crushing may be present in one SOP Instance.

C.8.13.5.xx.3 Relationship of ASL Timing Attributes

The general description of the ASL Acquisition technique requires a number of time related attributes that are depicted in figure C.8.13-X.

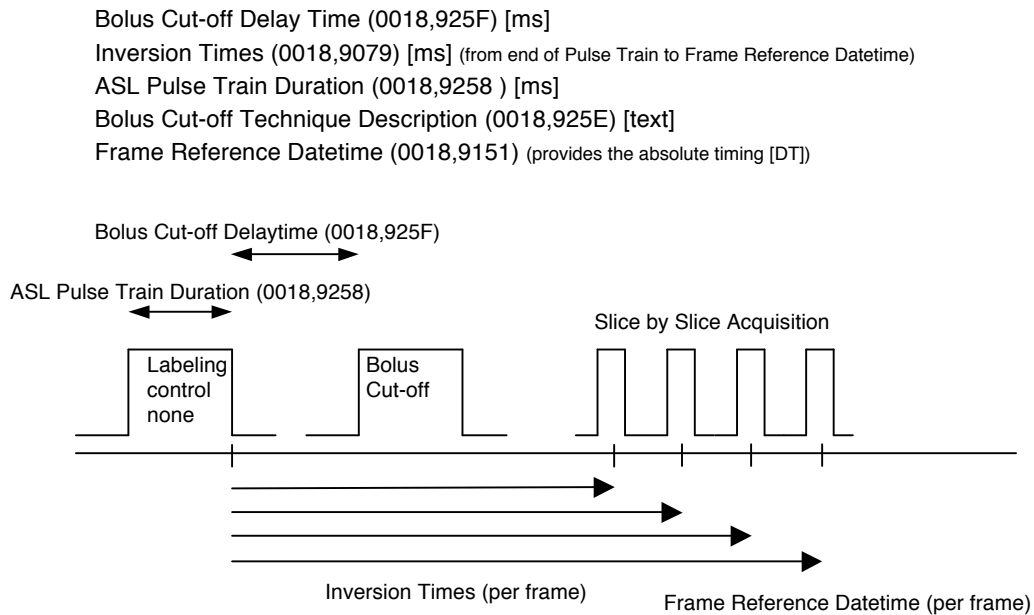


Figure C.8.13-X
Attributes for Quantitative ASL

Item #5: Add new elements to PS 3.6:

6 Registry of DICOM data elements

Tag	Name	Keyword	VR	VM
(0018,9250)	Arterial Spin Labeling Contrast	ArterialSpinLabelingContrast	CS	1

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ASL Attributes for MR

Date 2010/02/06
Status: Final Text

(0018,9251)	MR Arterial Spin Labeling Sequence	MRArterialSpinLabelingSequenc e	SQ	1
(0018,9252)	ASL Technique Description	ASLTechniqueDescription	LO	1
(0018,9253)	ASL Slab Number	ASLSlabNumber	US	1
(0018,9254)	ASL Slab Thickness	ASLSlabThickness	FD	1
(0018,9255)	ASL Slab Orientation	ASLSlabOrientation	FD	3
(0018,9256)	ASL Mid Slab Position	ASLMidSlab Position	FD	3
(0018,9257)	ASL Context	ASLContext	CS	1
(0018,9258)	ASL Pulse Train Duration	ASLPulseTrainDuration	UL	1
(0018,9259)	ASL Crusher Flag	ASLCrusherFlag	CS	1
(0018,925A)	ASL Crusher Flow Limit	ASLCrusherFlowLimit	FD	1
(0018,925B)	ASL Crusher Description	ASLCrusherDescription	LO	1
(0018,925C)	ASL Bolus Cut-off Flag	ASLBolusCutoffFlag	CS	1
(0018,925D)	ASL Bolus Cut-off Timing Sequence	ASLBolusCutoffTimingSequence	SQ	1
(0018,925E)	ASL Bolus Cut-off Technique	ASLBolusCutoffTechnique	LO	1
(0018,925F)	ASL Bolus Cut-off Delay Time	ASLBolusCutoffDelayTime	UL	1
(0018,9260)	ASL Slab Sequence	ASLSlabSequence	SQ	1