10 minutes on... radiation dose reduction in computed tomography

Case report CTA abdomen

Christian Loewe Dep. of Bioimaging and Image Guided Therapy, Medical University of Vienna For personal use

Medical history

A 12-year-old female patient presents with acute abdominal pain.

She has a history of successfully treated acute lymphatic leukemia. Additionally, there is a known history of acute pancreatitis.

On admission, she has a body weight of 40kg and reports severe abdominal pain with acute onset. The abdomen is hard and physical examination is extremely painful. There is no history of recent trauma.

The blood samples show no signs of acute infection or acute pancreatitis, but the hematocrit counts are decreased.

Question 1: answer + explanation

- Go for acute surgery: **No**. Given the history, localization of the suspected bleeding is required!
- Go for invasive angiography under the suspicion of acute bleeding
 No. Angio will not be positive in the case of non-active bleeding!
- Go for MRI of the abdomen (to avoid radiation exposure since pateint is a child). No. In the acute setting and because of its limited spatial resolution, MR/MRA is not the method of first choice
- Go for CTA. **Yes.** Fast, reliable, with high spatial resoliution and safe, if optimized protocol is applied

Question 2: how would you plan your CTA?

• Arterial phase only

• Biphasic scan (arterial and venous)

• Biphasic scan (native and arterial)

• Triphasic scan (native, arterial and venous)

Question 2: answer + explanation

- Arterial phase only: No. Slow-flow bleeding will not be detected
- Biphasic scan (arterial and venous): Yes. Both arterial source of bleeding as well as contrast accumulation due to slow flow are visualized
- Biphasic scan (native and arterial): **No.** Venous phase is important.
- Triphasic scan (native, arterial and venous): **No.** Dose too high and less information due to additional native scan

Examination (scan technique)

The examination is performed on a third-generation Dual-Source-Multidetector CT system (Siemens Somatom Force).

The following scan parameters have been applied:

- slice collimation 128x0.6.
- biphasic acquisition (arterial phase, venous phase)
- 80 kVp
- 78 mAs (arterial phase) and 118 mAs (venous phase).
- total dose (entire acquisition): 120 mGycm; 50/2

Examination (contrast administration)

The examination is performed on a third-generation Dual-Source-Multidetector CT system (Siemens Somatom Force).

The following contrast parameters have been applied:

- total contrast volume: 50 ml
- iodine concentration of contrast used: 400mg
- contrast flow: 2ml/sec
- iodine delivery rate (power injector): 800mg/sec

Examination (reconstruction)

The examination is performed on a third-generation Dual-Source-Multidetector CT system (Siemens Somatom Force).

The following reconstructions have been calculated:

- secondary raw data set:
- axial data set (arterial phase):
- axial data set (venous phase):
- coronal data set (arterial phase):
- coronal data set (venous phase):

- axial, 1mm / 0.8 increment
- axial, 3mm / 2 increment

• VRT

Description of the second seco

axial MPR (3/2) – arterial – venous phase



Description of the second seco

coronal MPR (3/2) – arterial – venous phase



Description of the second seco

coronal MPR (3/2) - venous phase



CT Angiography of the Abdomen – Case Report



VRT (arterial phase)





Scan protocol

Total mAs	2501	Total DLP 120) mGycm						
		Scan	ΚV	mAs	/ ref.	CTDivol* mGy	DLP mGycm	TI s	cSL mm
Patient Pos	sition F-	SP							
Topogram		1	Sn100	20 r	nΑ	0.01 L	0.3	4.8	0.61
PreMonitoring Contrast		2	100	20		0.54 L	0.5	0.28	10.0
Monitoring		3	100	20		0.54 L	0.5	0.28	10.0
Liver art		4D	80	78	/318	1.08 L	37.8	0.28	0.6
Abd ven		5D	80	118	/450	1.63 L	81.1	0.28	0.6
Medium	Туре		loc	lodine Conc. ma/ml		Volume ml	Flow ml/s	CN	Ratio
				112					
Contrast	IOM 40	00		4	00	0	0.0		100%
Saline						0	0.0		

Question 3: your diagnosis?

• large hematoma due to active bleeding from gastroepiploic artery

• chronic pancreatitis

• inflammatory pseudotumor

• bulky lymph nodes



Question 3: answer

 large hematoma due to active bleeding from gastroepiploic artery

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Conclusion

- Scanning at low kVp settings is feasible in CT angiography
- Scanning at low kVp settings allows for low radiation exposure and decreased amount of contrast agent
- Venous phase scanning is required to detect slow-flow bleeding, visualize contrast extravasation, and assess parenchymal organs and small and large bowel wall