

## **Perfusional defects on CTP for the early detection of delayed cerebral ischemia (DCI) after aneurysmal subarachnoid hemorrhage (aSAH).**

**Poster No.:** C-1208  
**Congress:** ECR 2018  
**Type:** Scientific Exhibit  
**Authors:** E. Puglielli<sup>1</sup>, R. Lattanzi<sup>2</sup>, V. Di Mizio<sup>2</sup>, V. Di Egidio<sup>2</sup>; <sup>1</sup>Teramo, ITALY/IT, <sup>2</sup>Teramo/IT  
**Keywords:** Emergency, Interventional vascular, Neuroradiology brain, CT-Angiography, CT, Image manipulation / Reconstruction, Contrast agent-intravenous, Computer Applications-Detection, diagnosis, Treatment effects, Aneurysms, Outcomes, Ischaemia / Infarction  
**DOI:** 10.1594/ecr2018/C-1208

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

[www.myESR.org](http://www.myESR.org)

## **Aims and objectives**

**After aneurysmal subarachnoid hemorrhage (aSAH), vasospasm, edema, hydrocephalus or craniotomy can cause perfusional defects. The delayed arrival of contrast may overestimate the ischemic area in DCI after aSAH. Aim of this work is to analyse the diagnostic accuracy of CTP finding in DCI and final outcome after SAH.**

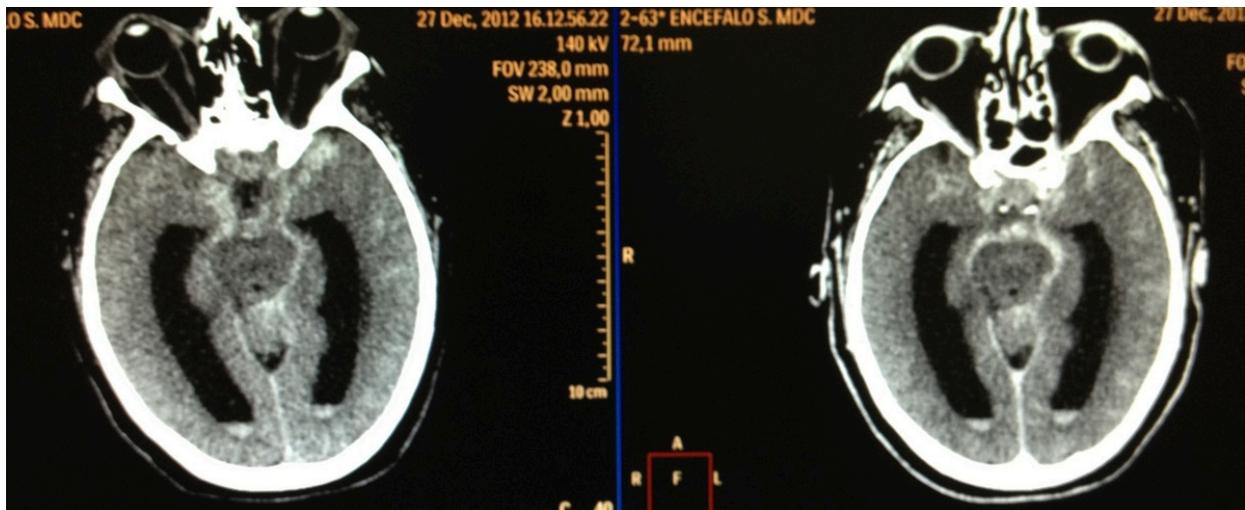
## Methods and materials

We included 415 consecutive patients with symptomatic aSAH (mean age 61,8y, april 2009-september 2017), who underwent NCCT/CTP/CTA for imaging and subsequent endovascular treatment with permanent exclusion. Clinical deterioration after aSAH were categorized into DCI and no DCI. CTP maps were automatically calculated tracer delay-sensitive algorithms and were also visually assessed for the presence of perfusional defects by two independent experienced readers. Age, sex, comorbidity, Hunt-Hess score at presentation, outcome (mRS<2), vasospasm evaluated with TICl and CTP were correlated using a multiple logistic regression analysis ( $p<0.005$ ).

## Results

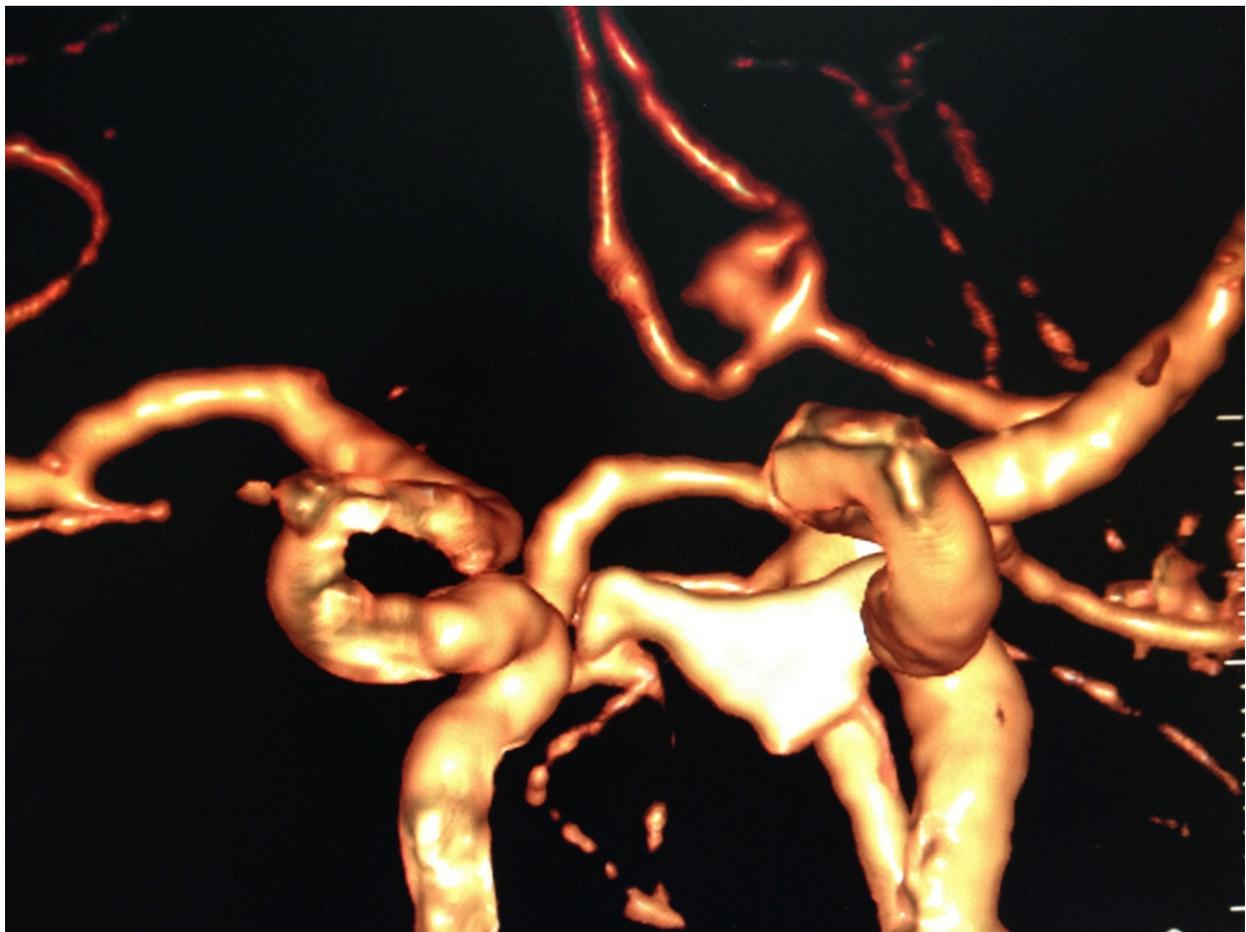
For diagnosing DCI on the CTP maps shows a significant reduction of CBV and increase of MTT (356/415 patients 85.83%) suggestive for vasospasm that lead poor outcome 12.64% (45/356); the positive predictive values (PPVs) were 0.81 (0.58 to 0.95) for the MTT and negative predictive values (NPVs) 0.57 (0.18 TO 0.90) for the detection of microangiopathy in the DCI group. Patients with severe vasospasm on CTA, have PPVs and NPVs values that did not significantly differ on MTT and CBF analysis.

Images for this section:



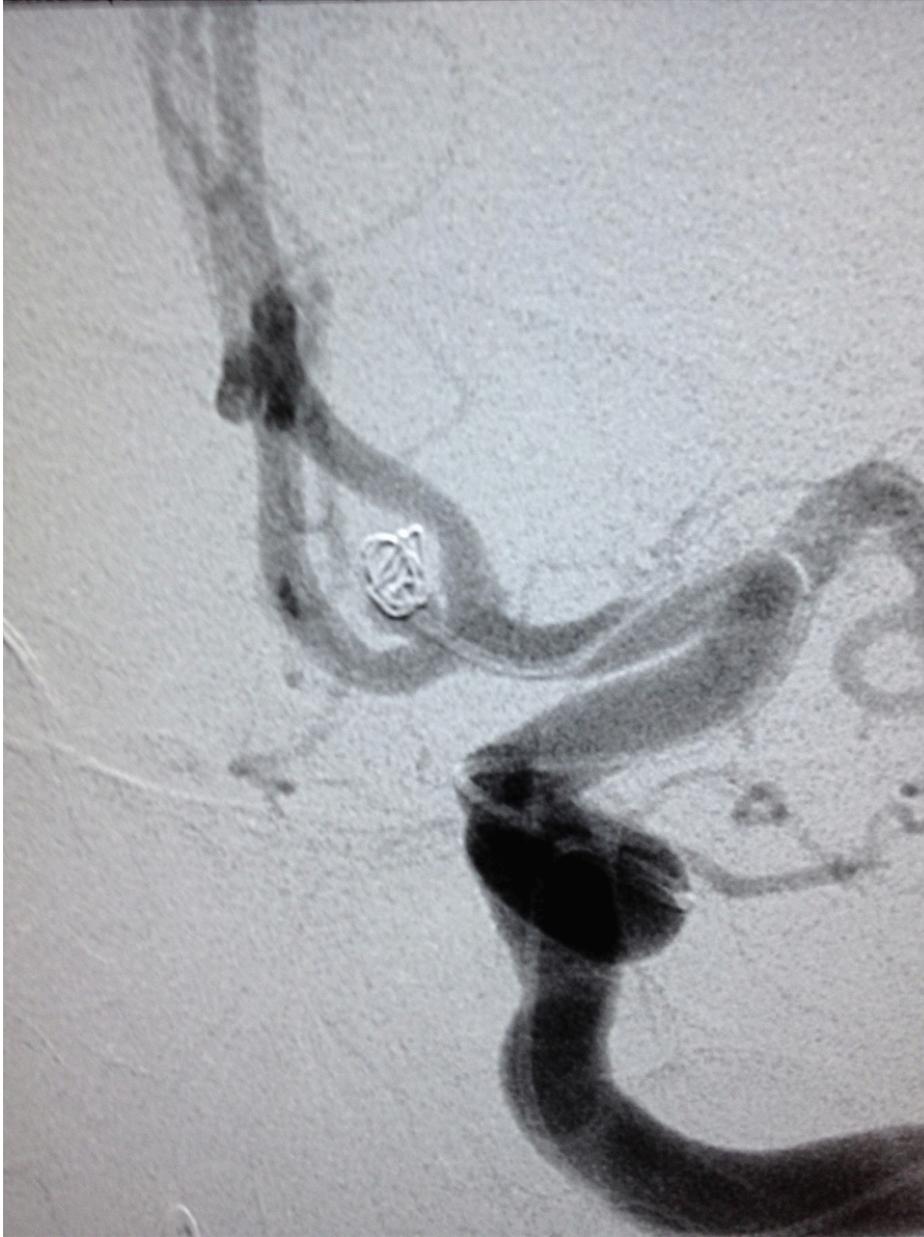
**Fig. 1:** NECT: aneurysmal subarachnoid hemorrhage (aSAH), edema and hydrocephalus is already present at 18hrs.

© RADIOLOGY, ASL TERAMO, "G. Mazzini" Hospital - Teramo/IT



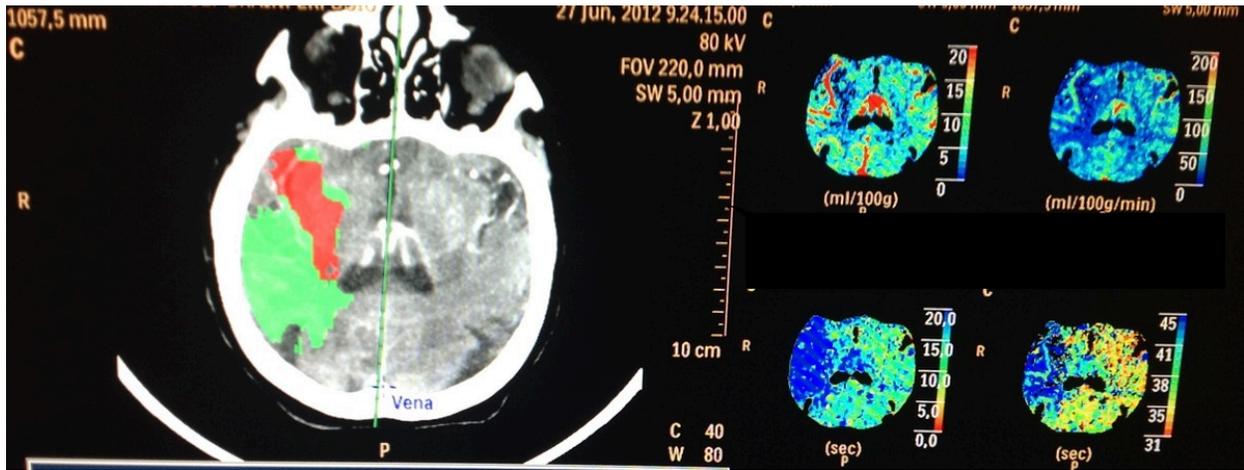
**Fig. 2:** CT Angio: 3D V.R. visualization. ACom aneurysmal rupture with subarachnoid hemorrhage (aSAH), vasospasm, edema and hydrocephalus.

© RADIOLOGY, ASL TERAMO, "G. Mazzini" Hospital - Teramo/IT



**Fig. 3:** Digital Subtraction Angiography: Anterior view. After aneurysmal intraluminal coiling, clinical deterioration is present and perfusional CT was performed. The delayed arrival of contrast may overestimate the ischemic area in DCI after aSAH.

© RADIOLOGY, ASL TERAMO, "G. Mazzini" Hospital - Teramo/IT



**Fig. 4:** CT Perfusion maps were automatically calculated tracer delay-sensitive algorithms and were also visually assessed for the presence of perfusional defects.

© RADIOLOGY, ASL TERAMO, "G. Mazzini" Hospital - Teramo/IT

## Conclusion

CTP/CTA can be used for qualitative evaluation of DCI in patients with aSAH but more efforts are needed to evaluate the exact relationships between imaging and outcome.

## **Personal information**

**Edoardo G. Puglielli**

**Chief of Interventional and Vascular Radiology,**

**"G. Mazzini" Hospital, Teramo, Italy**

**ASL TERAMO**

Tel. +039.0861.429929

Fax: +039.0861.429309

## References

1. Murphy A, de Oliveira Manoel AL, Burgers K, Kouzmina E, Lee T, Macdonald RL, Bharatha A. Early CT perfusion changes and blood-brain barrier permeability after aneurysmal subarachnoid hemorrhage. *Neuroradiology*. 2015 Apr 14. Epub ahead of print.
2. Lei Q, Li S, Zheng R, Xu K, Li S. Endothelin-1 expression and alterations of cerebral microcirculation after experimental subarachnoid hemorrhage. *Neuroradiology*. 2015 Jan;57(1):63-70. doi: 10.1007/s00234-014-1435-y. Epub 2014 Oct 5.
3. Rasmussen R, Juhler M, Wetterslev J. Effects of continuous prostacyclin infusion on regional blood flow and cerebral vasospasm following subarachnoid haemorrhage: statistical analysis plan for a randomized controlled trial. *Trials*. 2014 Jun 14;15:228. doi: 10.1186/1745-6215-15-228.
4. Zheng R, Qin L, Li S, Xu K, Geng H. CT perfusion-derived mean transit time of cortical brain has a negative correlation with the plasma level of Nitric Oxide after subarachnoid hemorrhage. *Acta Neurochir (Wien)*. 2014 Mar;156(3):527-33. doi: 10.1007/s00701-013-1968-6. Epub 2013 Dec 24.
5. Tateyama K, Kobayashi S, Murai Y, Teramoto A. Assessment of cerebral circulation in the acute phase of subarachnoid hemorrhage using perfusion computed tomography. *J Nippon Med Sch*. 2013;80(2):110-8.
6. Honda M, Sase S, Yokota K, Ichibayashi R, Yoshihara K, Sakata Y, Masuda H, Uekusa H, Seiki Y, Kishi T. Early cerebral circulatory disturbance in patients suffering subarachnoid hemorrhage prior to the delayed cerebral vasospasm stage: xenon computed tomography and perfusion computed tomography study. *Neurol Med Chir (Tokyo)*. 2012;52(7):488-94.
7. Changes in cerebral perfusion around the time of delayed cerebral ischemia in subarachnoid hemorrhage patients. Dankbaar JW, de Rooij NK, Smit EJ, Velthuis BK, Frijns CJ, Rinkel GJ, van der Schaaf IC. *Cerebrovasc Dis*. 2011;32(2):133-40. doi: 10.1159/000328244. Epub 2011 Jul 19.

8. Chen F, Wang X, Wu B. Neuroimaging research on cerebrovascular spasm and its current progress. *Acta Neurochir Suppl.* 2011;110(Pt 2):233-7. doi: 10.1007/978-3-7091-0356-2\_42. Review.

9. Schubert GA, Seiz M, Hegewald AA, Manville J, Thomé C. Acute hypoperfusion immediately after subarachnoid hemorrhage: a xenon contrast-enhanced CT study. *J Neurotrauma.* 2009 Dec;26(12):2225-31. doi: 10.1089/neu.2009.0924.

10. Harrigan MR, Magnano CR, Guterman LR, Hopkins LN. Computed tomographic perfusion in the management of aneurysmal subarachnoid hemorrhage: new application of an existent technique.

*Neurosurgery.* 2005 Feb;56(2):304-17; discussion 304-17. Review.