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# Endovascular carotid sub-total occlusion management and hemodynamic examination

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## Disclosure

Speaker name:

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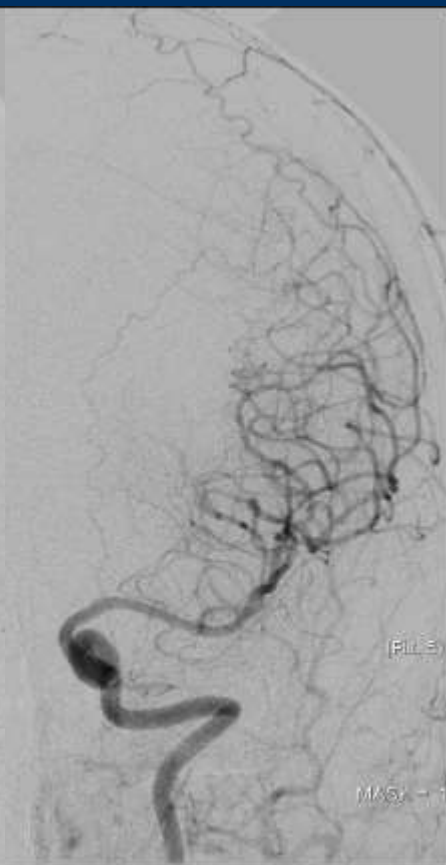
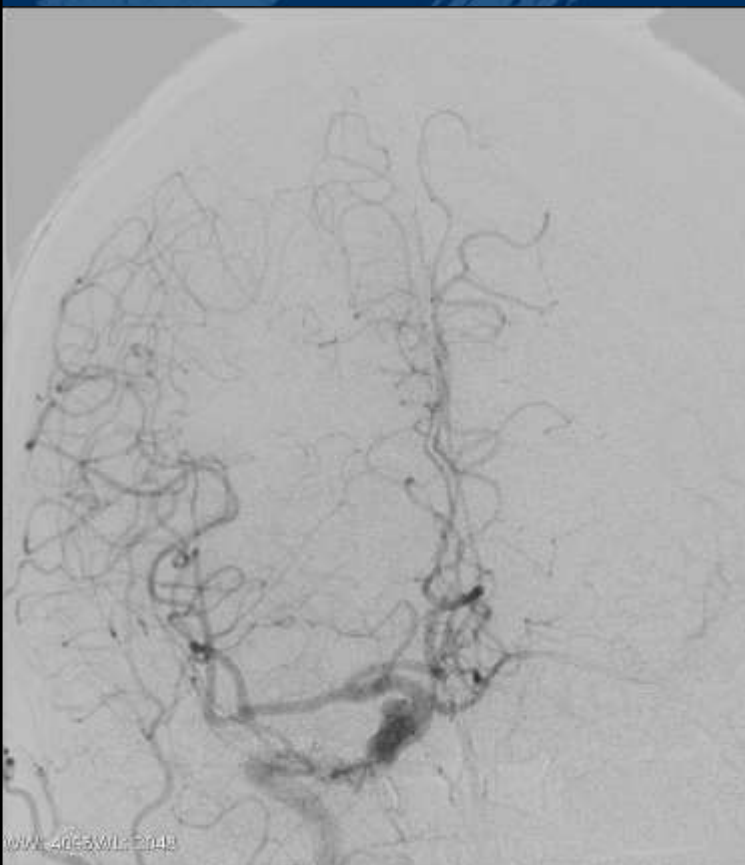
I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s)
  
- I do not have any potential conflict of interest



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- 65y male
- Dizzy and blurred vision





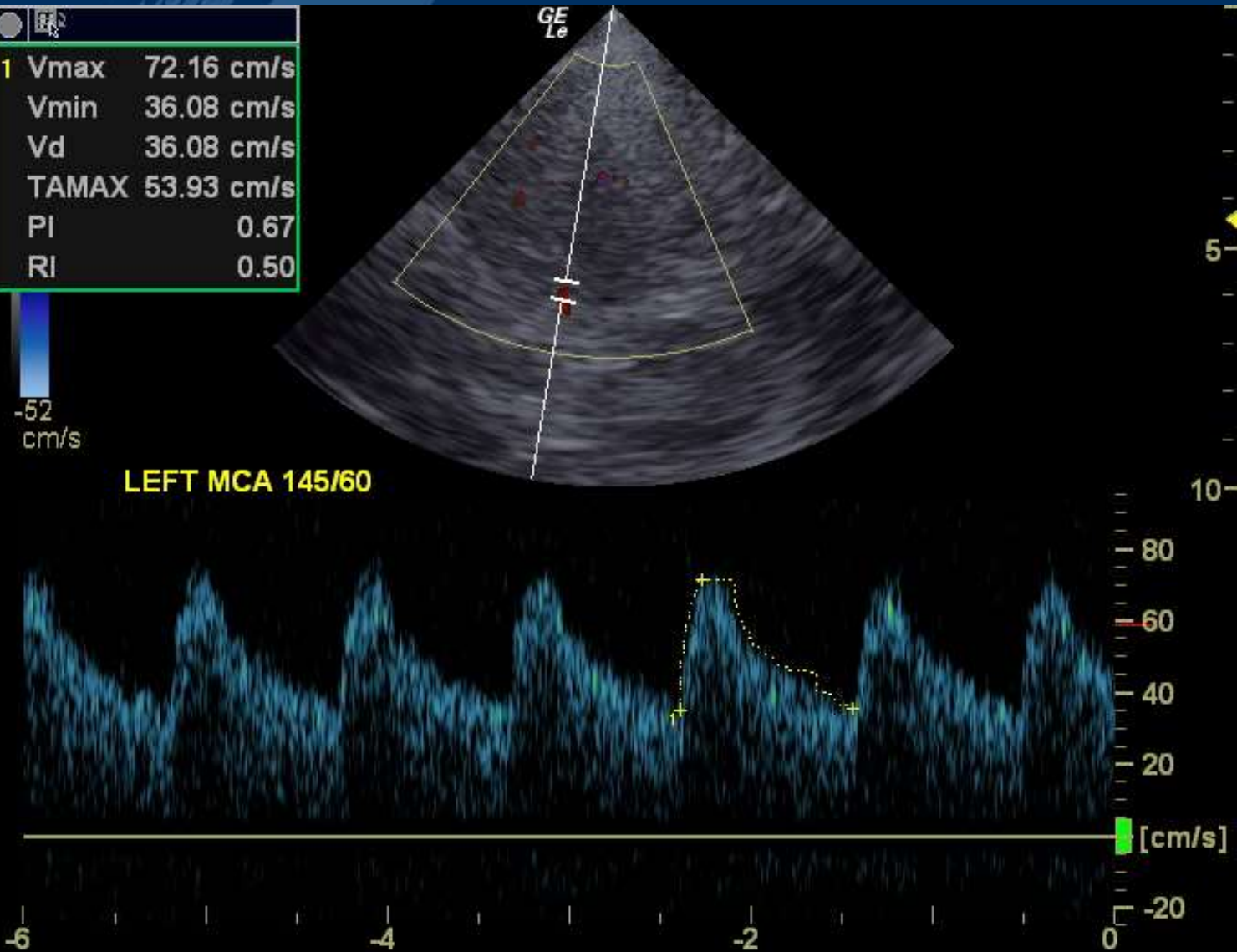
# TCCD before CAS:

LINC ipsilateral MCA Vmax 72cm/s

1	Vmax	72.16 cm/s
	Vmin	36.08 cm/s
	Vd	36.08 cm/s
	TAMAX	53.93 cm/s
	PI	0.67
	RI	0.50



LEFT MCA 145/60





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# After CAS:

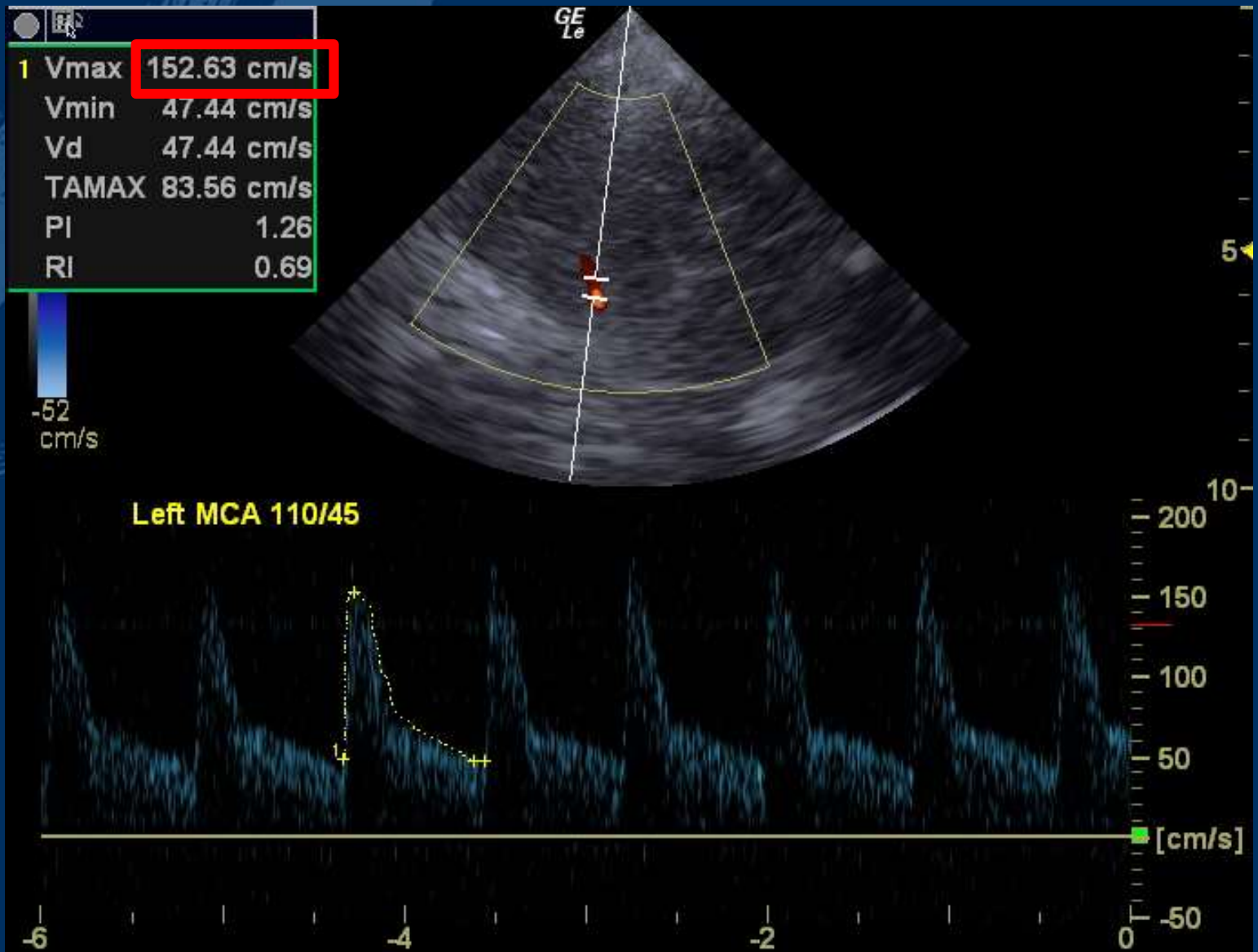


**The patient got HD immediately after stenting. Then we used dopamine and the systolic BP was maintained between 100-120mmHg.**



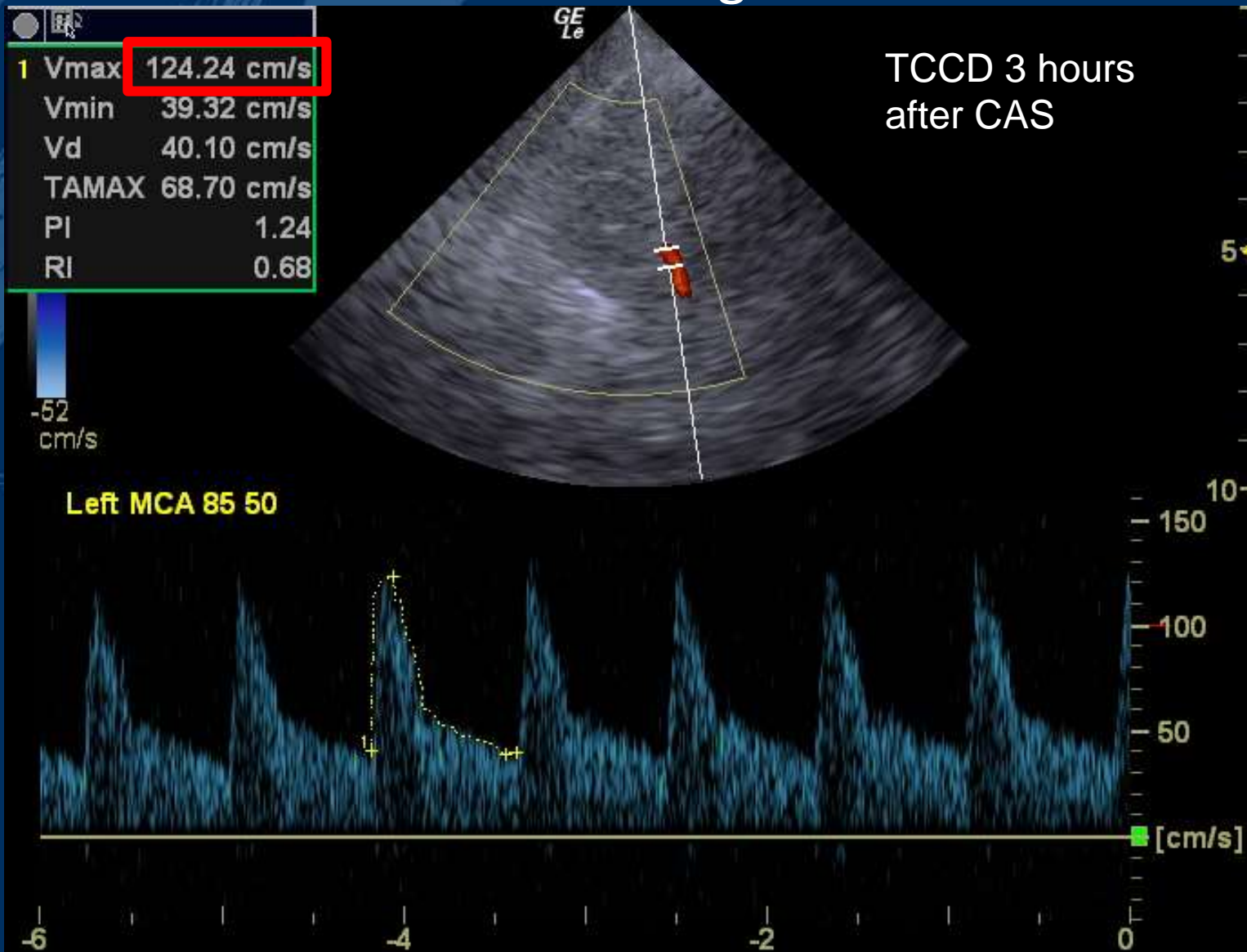
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The patient complained headache and the TCCD showed MCA Vmax increased  $> 100\%$  1h after



Then systolic BP was strictly controlled between 80 and 100mmHg

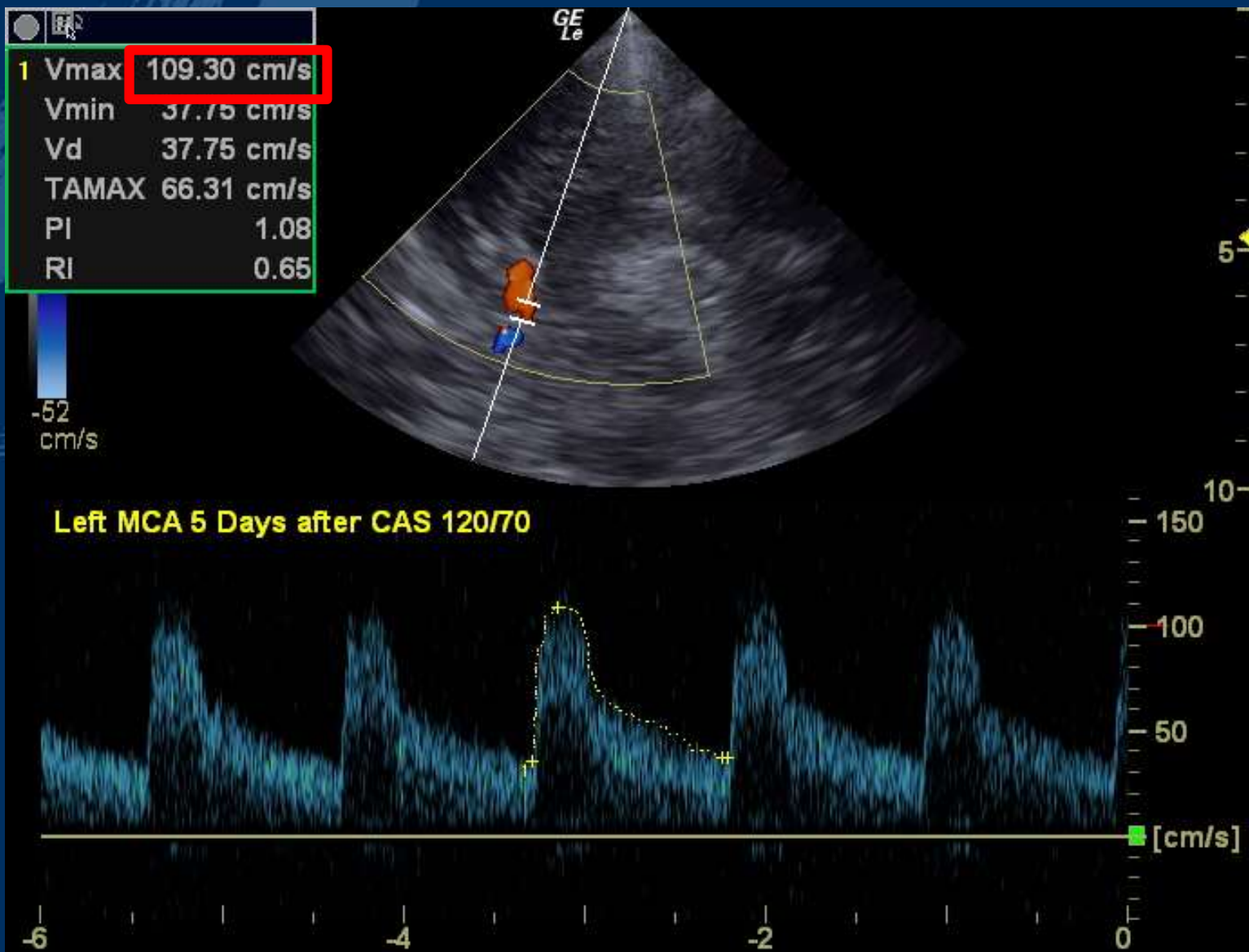
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After the BP control, the patient's headache relieved and discharged after 1 week.







# Discussion

- Severe hemodynamic instability may occur after CAS for a near occlusion (NO) patient
  - Hyperperfusion syndrome (cerebral hemorrhage)
  - Hemodynamic depression (Increasing risk of stroke and MI)
- A precise BP control **according to the intracranial blood flow** may be feasible to reduce the peri procedure complications



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# Monitoring of cerebral hemodynamic changes can be used to predict hyperperfusion syndrome

**Predictors of Cerebral Reperfusion Injury After Carotid Stenting: The Role of Transcranial Color-Coded Doppler Ultrasonography**

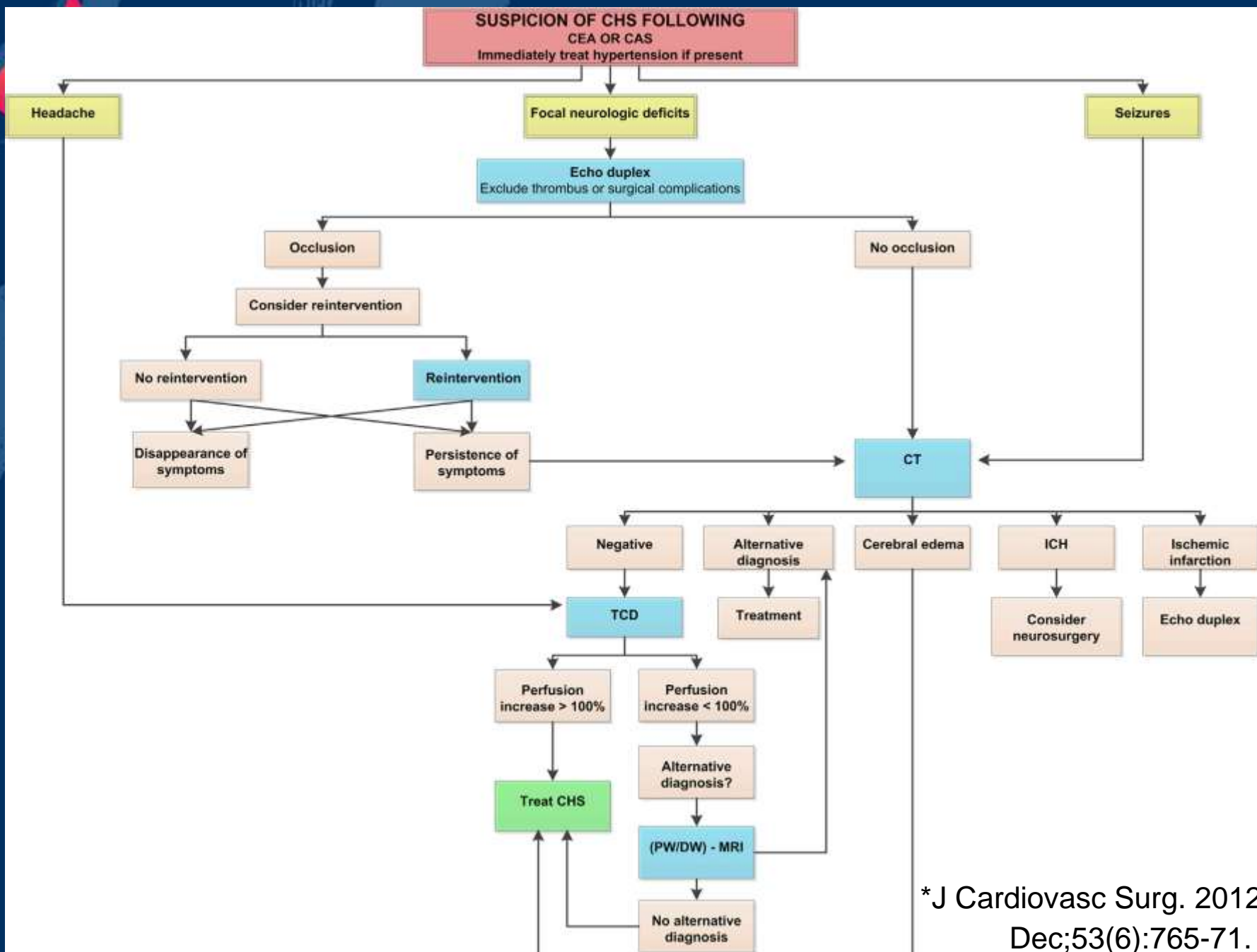
*J Endovasc Ther* August 2010 17: 556-563,

## •TCD:

- (Transcranial Doppler)
- or TCCD (Transcranial color-code Doppler)
  - Noninvasive, easy to perform
  - Hyperperfusion syndrome is generally defined as the TCD measured cerebral blood flow increase  $>100\%$  over baseline\*
  - The hemodynamic changes in the early stage after CAS is still largely unknown
  - No research regards of near occlusion

\*J Cardiovasc Surg. 2012 Dec;53(6):765-71

\*Lancet Neurol 2005; 4: 877-88



\* J Cardiovasc Surg. 2012  
Dec;53(6):765-71.



- Carotid artery
  - near occlusion
  - pseudo occlusion
  - incomplete occlusion
  - subtotal occlusion



## 4 angiographic criteria for near occlusion(NO):

- Delayed Time of Contrast Arrival
- Evidence of Collaterals
- ICA-to-ICA Comparison of Diameter Reduction
- ICA-to-ECA Comparison of Diameter Reduction



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# Delayed Time of Contrast Arrival of the internal carotid artery(ICA)





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# *Evidence of Collaterals*





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# *ICA-to-ICA Comparison of Diameter Reduction*







# *ICA-to-ECA Comparison of Diameter Reduction*





- Delayed Time
- Collaterals
- ICA-to-ICA or
- ICA-to-ECA Diameter Reduction

$\geq 2$



# Our research

- Data were collected from 57 patients:
  - unilateral  $>70\%$  carotid artery stenosis
  - Successfully underwent CAS
  - Their MCA Blood flow velocity were successfully recorded by TCD or TCCD, at the day before, 1 hour and 3 hours after CAS.
- 11 patients were near occlusion(NO)



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	Not-NO (n=46)	NO (n=11)	P
Male	39	10	0.745
Age≥70	20	4	0.815
Hypertension	37	7	0.327
Smoking	27	7	0.412
Diabetes	16	2	0.267
Severe contralateral carotid artery stenosis	6	1	0.561
<b>Hemodynamic depression</b>	16	5	0.563
<b>Hyperperfusion</b>	0	Headache 1 Asym 1	<b>0.022</b>
Stroke, myocardial infarction, renal failure and other events	Minor stroke 1	0	0.733



# Changes of BP

	BP before CAS (mmHg)	BP 1 hour after CAS (mmHg)	Increase of percentage	BP 3 hours after CAS (mmHg)	Increase of percentage
<b>Not-NO</b>	147.9 ± 15.1	122.0 ± 11.9	-17.5% (P<.001)	120.6 ± 11.7	-18.5% (P<.001)
<b>NO</b>	144.4 ± 15.7	116.9 ± 25.5	-19.0% (P<.001)	116.4 ± 15.4	-19.4% (P<.001)



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Ipsi-MCA Vmax before CAS(cm/s)	Ipsi-MCA Vmax 1 hour after CAS(cm/s)	P	MCA Vmax increase rate
84.1 ± 21.3	96.8 ± 28.3	<0.001	15.1%
	Ipsi-MCA Vmax 3 hour after CAS(cm/s)	P	MCA Vmax increase rate
	95.6 ± 25.5	0.003	13.7%
NO:			
Ipsi-MCA Vmax before CAS(cm/s)	Ipsi-MCA Vmax 1 hour after CAS(cm/s)	P	MCA Vmax increase rate
79.7 ± 29.4	113.0 ± 31.2	0.002	41.8%
	Ipsi-MCA Vmax 3 hour after CAS(cm/s)	P	MCA Vmax increase rate
	109.6 ± 36.0	0.016	37.5%



- Results:

- In both groups cerebral blood flow increased in the early stage after CAS.
- The increase rate in the NO group is significantly higher than the Not-NO group.

	n	1h MCA Vmax Increase rate	P	3h MCA Vmax Increase rate	P
Not-NO	46	15.1%	<u>0.005</u>	13.7%	<u>0.003</u>
NO	11	41.8%		37.5%	

Limitations of this study: limited sample size



# Conclusions

- Transcranial Doppler can be used to monitor the cerebral blood flow during the periprocedural period of CAS.
- There are more hemodynamic changes in the near occlusion group after CAS.
- It is important to monitor cerebral blood flow during the periprocedural period of carotid artery near occlusion stenting.





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Thank you for attention



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