Safety and efficacy of treatment in acute ischemic stroke secondary to tandem internal carotid artery/middle cerebral artery occlusion: a single-center experience.

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OBJECTIVES

Compared to single intracranial artery occlusion, treatment and recanalization of tandem internal carotid artery (ICA) / intracranial artery occlusion (TO) remain extremely challenging. After all recent results from endovascular stroke trials, although new perspectives have been opened for the treatment of severe stroke secondary to intracranial artery occlusion [1-2], to date there is not yet a standardized recommendation for emergent management of TO. According to the low recanalization rate and poor outcome reported after intravenous thrombolysis [3], more data on current reperfusion strategies in TO are needed. The aim of our study was to report on safety and efficacy outcomes of endovascular treatment (ET) in a large cohort of patients with anterior circulation acute ischemic stroke (AIS) due to TO occlusion. We further investigated clinical and imaging predictors of outcome.

METHODS

Subjects and study procedures: Patients with anterior circulation AIS who underwent ET between august 2009 and January 2016 were retrospectively collected. Patients were selected based on following criteria: 1. CT-angiography (CTA) documentation of TO (extracranial ICA plus terminal ICA or M1 or M2 or A1 or a combination of them); 2. onset to groin puncture (OGT) within 5 hours from symptom onset; 3. severe clinical deficit with NIHSS≥ 10; 4. premorbid mRS≤ 2; 5. available 3 months follow-up.

Treatment: Intravenous thrombolysis (IVT) (rtPA 0.9 mg/kg, 10% as bolus and the remaining in 60 min) within 4.5 hours after symptoms onset and continued during endovascular procedure. In case of an unstable or subocclusive plaque or dissection in the extracranial ICA, a direct closed-cells **stenting** was placed (Wallstent, Boston Scientific, Natick, MA, USA). Post-stenting **angioplasty** (Falcon Grande, Medtronic Minneapolis, MN, USA) was performed if a suboptimal angiographic result was achieved (lumen stenosis >30%). Intracranial **thrombectomy**using a 6 Fr guiding catheter (Neuron 070, Penumbra Inc., Alameda, CA, USA or Envoy DA, Codman & Shurtleff Inc, Raynham, MA, USA). Over the years, due to technological progress, different devices have been used such as penumbra aspiration system (Penumbra, Alameda, California, USA), stent retriever systems such as Solitaire AB (ev3 Inc, Plymouth, MN, USA), Revive SE (Codman &Shurtleff,Inc, Raynham, MA, USA), Trevo Retriever (Stryker Neurovascular, Mountain View, CA, USA) and, more recently, new aspiration devices such as Penumbra MAX ACE aspiration system.

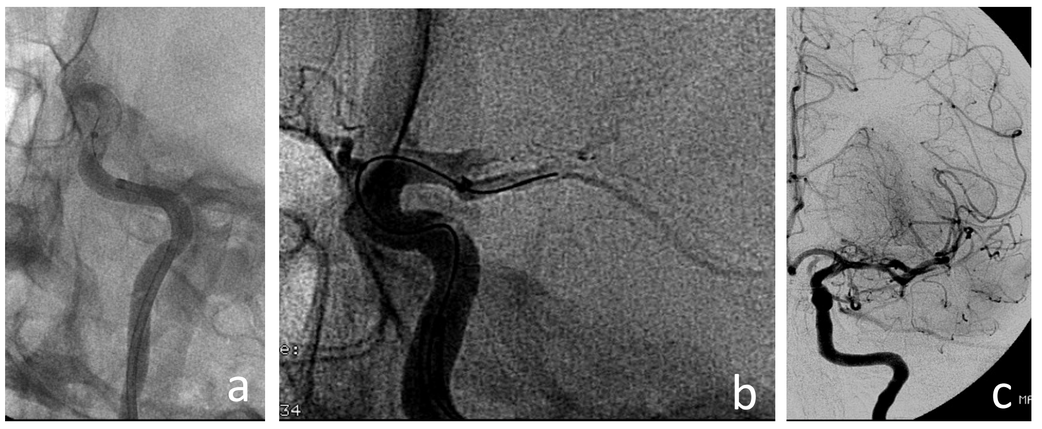

Figure. 61 y.o. patient presenting with right hemiplegia and aphasia (NIHSS:23). Digital subtraction angiography revealed tandem occlusion (a) treated by means of IVT followed by thromboaspiration by PS started 125 min after symptom onset: the separator advancing in the MCA is shown in b while ICA and MCA recanalization (TIMI 3) obtained 254 min after symptom onset is shown in c.

RESULTS

Clinical and radiological characteristics

Baseline variables	*N of patients=72*
Age (ys) mean±SD	65.6±12.8
Male gender (%)	44(61.1)
NIHSS mean±SD	19±2.9
Hypertension (%)	53(73.6)
Diabetes (%)	12(16.6)
Atrial fibrillation (%)	22(30.5)
Current Smoking (%)	3(4.1)
ASPECTS	6.9±2.28
Extracranial ICA subocclusion/occlusion	66(91.6)
Site of intracranial occlusion (%)	
M1	36(50)
M2	8(11.1)
t-ICA	3(4.1)
A1 + M1	3(4.1)
t-ICA + M1	22(30.5)
Collateral adequacy (%)	
Fair	31(43)
Poor	41(57)

M1: proximal portion of the middle cerebral artery; M2: mid portion of the middle cerebral artery; A1: proximal portion of anterior cerebral artery; t-ICA: terminal intracranial internal carotid artery.

Treatment characteristics

Extracranial CAS (%)	35(48.6)
IVT (%)	37(51.3)
APT (%)	
Dual	12(16.6)
Single	26(36.1)
None	34(47.2)
Intravenous heparin (%)	40(55.5)
OTR, min (mean±SD)	325.1±95
Device attempts (n)	3.2±1.9

CAS: carotid artery stenting; IVT: intravenous thrombolysis; APT: antiplatelet therapy; OTG: onset to groin puncture time; OTR: onset to reperfusion time; GTR: groin puncture to reperfusion time

Univariable analysis of factors predicting 3-months outcome

Variable	*Good outcome (23)*	*Poor outcome (49)*	*p-value*
Age	59.43±11,72	68.57±12.41	0.004
Right hemisphere (%)	13(56.5)	24(49)	0.6
Single intracranial occlusion (%)	17(74)	28(57)	0.2
IVT (%)	14(61)	25(51)	0.4
GA (%)	20(87)	34(69.3)	0.1
CAS (%)	14(61)	21(43)	0.2
CAS patency (%)	14(100)	20(95)	1.00
Baseline ASPECTS (mean±SD)	8.22±1.81	6.34±2.15	0.0005
Acute none APT (%)	8(34.5)	26(53)	0.2
Thromboaspiration device (%)	15(65)	32(65.3)	1.00
Rescue device (%)	6(26)	17(34.7)	0.5
OGP (min, mean±SD)	240.23±124.72	229.51±76.67	0.66
OTR (min, *mean±SD*)	316.95±56.34	328.8±83.15	0.63
GPR (min, mean±SD)	78.09±35.3	97.06±52.26	0.12
TICI≥2b (%)	21(91.3)	25(51)	0.001
Device passages (mean±SD)	2.30±1.58	3.57±1.91	0.007
Fair Collateral flow (%)	18(78)	13(26.5)	0.0001
Onset NIHSS (mean±SD)	18.17±3	19.47±2.82	0.07
ICH (%)	6(26)	28(57)	0.02
Symptomatic ICH (%)	0	9(18.3)	0.04
Procedural IV Heparin (%)	11(48)	29(59)	0.4
Follow-up ASPECTS (mean±SD)	4.35±2.38	1.84±1.91	<0.0001

Multivariable logistic regression: predictors of good outcome

	OR	SE	95% CI	p
Age	0.92	0.03	0.87 - 0.98	0.013
ASPECTS	1.33	0.27	0.90 - 1.98	0.149
TICI 2b-3	6.40	6.39	0.90 - 45.36	0.063
Device passages	0.93	0.22	0.58 - 1.47	0.750
Fair Collaterals	5.18	4.09	1.10 - 24.33	0.037
ICH	0.21	0.17	0.04 - 1.08	0.62

Age and good collaterals were significant and independent predictors of good outcome

Univariable analysis of risk factors for sICH

Variable	*sICH (9)*	*No sICH(63)*	*p-value*
IV Heparin (%)	7(77)	35(55.5)	0.28
IV Thrombolysis (%)	4(44)	33(52)	0.73
IV Lysine acetylsalicylate *(%)*	3(33)	5(8%)	0.05
Double APT (%)	1(11)	11(17.5)	1.00
Baseline ASPECTS (mean±SD)	5.1±1.7	7.2±2.1	0.006
Fair collateral flow (%)	0	31(49)	0.008
Onset NIHSS (mean±SD)	19.6±2.6	18.9±2.9	0.5
CAS %	4(44)	31(49)	1.00
Thromboaspiration device (%)	6(66.5)	41(65)	1.00
Rescue device (%)	7(77)	16(25.5)	0.003
TICI≥2b (%)	4(44)	42(66.5)	0.2
OTR (min, *mean±SD*)	275±69.7	318.7±97	0.13
GPR (min, *mean±SD*)	129.66±78.22	85.47±40.12	0.008
Device passages (mean±SD)	4.4±2.7	2.9±1.7	0.03

Multivariable logistic regression : predictors of sICH

	OR	SE	95% CI	p
IV Lysine ASA	4.32	5.83	0.30 - 60.97	0.278
ASPECTS	0.83	0.18	0.54 - 1.29	0.414
Fair Collaterals	0.09	0.11	0.01 - 1.09	0.059
Rescue device	10.74	11.28	1.37 - 84.13	0.024
GPR	1.01	0.01	0.99 - 1.04	0.253
Device passages	0.89	0.28	0.47 - 1.67	0.723

The only independent predictor of sICH was the use of an additional device for thrombectomy.

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CONCLUSIONS

1. ET for AIS secondary to TO can be performed with reasonable safety and efficacy.

2. Age, presence of good collaterals and the use of a rescue device for thrombectomy should be considered as crucial variables when planning future endovascular stroke trial on TO.