

Clinical and Radiological outcomes of contact aspiration thrombectomy in acute ischemic stroke

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Abstract

Background: Contact aspiration thrombectomy (CAT) using a large-bore aspiration catheter is increasingly performed as one of the major endovascular thrombectomy (EVT) methods around the world. Contact aspiration thrombectomy has been shown to be safe and effective for removal of clots in a recent randomized controlled trial which compared contact aspiration thrombectomy and stent retriever thrombectomy as a first line thrombectomy.

Aim of the study: To evaluate contact aspiration thrombectomy clinical outcomes at 90 days as compared to best medical management alone in subjects experiencing an acute ischemic stroke due to proximal anterior circulation large vessel occlusion when treatment is initiated within 24 h after last time seen well.

Results: Sixty two (62) ischemic stroke patients divided into two arms, thrombectomy arm 31 patients subjected to aspiration thrombectomy, other control group 31 patients received standard medical care alone. All patients show acute ischemic stroke in territory of anterior large vessel circulation (ICA &/or proximal M1, M2) documented by non-enhanced CT brain & CTA/MRA. (NIHSS) at admission; mean 17.15, Std. Deviation 4.69 CI (15.68-18.62). ASPECT score; mean 7.48, Std. Deviation 1.26, CI (7.07-7.88). The aspiration group had a significantly higher rate of functional independence (ie, a mRS score of 0 to 2) at 90 days compared with control group 45 versus 10 percent respectively, absolute risk difference, 4.5 percent, 95% CI (1.1-18.27), Fisher's Exact Test; P = 0.015 with statistically significant difference. 15 / 31 patients (50%) achieve modified Thrombolysis in Cerebral Infarction (mTICI) \geq 2b revascularization after aspiration thrombectomy as stand- alone procedure while 26 / 31 (90%) patients achieve TICI \geq 2b revascularization after aspiration with stent retrieval thrombectomy procedure. There were marked reduction in NIHSS score in thrombectomy group at discharge where, NIHSS at admission: for thrombectomy group; Mean 17.55, Std. Deviation 4, (C.I) (15.68-19.42). while, for control group Mean 16.75, Std. Deviation 5.2, (C.I) (14.31-19.19), student t test; P value = 0.59, no significant difference.

Conclusion: aspiration thrombectomy appears to be effective and safe for stroke endovascular therapy with better clinical and radiological outcomes over best medical therapy alone in anterior large vessel occlusion.

Key words: Thrombectomy, aspiration thrombectomy, stroke, endovascular.

Introduction:

Stroke considered the most common cause of death and disability in low-income and middle-income countries (**Avan et al., 2019**). Treatment for acute ischemic stroke has changed significantly over the years. Overall outcomes have improved substantially, with lower morbidity and mortality than ever before (**Messegee and Yonas ,2017**).

Since November 2014, nine positive randomized controlled trials of mechanical thrombectomy for large vessel occlusion in the anterior circulation have led to a revolution in the care of patients with acute ischemic stroke. Its efficacy is unmatched by any previous therapy in stroke medicine, with a number needed to treat of less than 3 for improved functional outcome (**Matthew et al., 2017**). Brain tissue may be rescued if blood flow is restored rapidly after onset of acute ischemic stroke. Intravenous recombinant tissue plasminogen activator (IV rtPA) and, since 2015, endovascular thrombectomy (intra-arterial therapy, IAT) can significantly improve the odds of disability-free recovery (**salwa and Keith 2017**). Patients with large-vessel occlusions and concomitant large ischemic infarcts once had an 80% mortality rate. New technologies now help nearly 80% of these patients to have long-term functional independence (**Snelling et al., 2019**). Two issues may limit the widespread clinical use of mechanical thrombectomy. First, only an estimated 10 percent of patients with acute ischemic stroke have a proximal large artery occlusion in the anterior circulation and present early enough to qualify for mechanical thrombectomy within 6 hours (**Chia et al., 2016**), while approximately 9 percent of patients presenting in the 6 to 24 hour time window may qualify for mechanical thrombectomy (**Jadhav et al., 2018**). Only a few stroke centers have sufficient resources and expertise to deliver this therapy (**Josephson and Kamel 2018**). Contact aspiration thrombectomy (CAT) using a large-bore aspiration catheter is increasingly performed as one of the major endovascular thrombectomy (EVT) methods around the world (**Gory et al., 2018**). Contact aspiration thrombectomy has been shown to be safe and effective for removal of clots in a recent randomized controlled trial which compared contact aspiration thrombectomy and stent retriever thrombectomy as a first-line thrombectomy (**Lapergue et al., 2017**)

Patients and Methods:

prospective, multicenter, case control, open-label clinical trial has been done between January 2020 and January 2022 in which 61 patients with ischemic stroke secondary to occlusion of the anterior circulation (occlusions of the distal ICA and/or M1 or M2 of MCA) included in the study and divided into two group: **Thrombectomy group** 31 patients from Ain Shams university hospitals who have received thrombectomy plus standard medical care. **Control group** 31 patients from Benha university hospitals who have received Standard medical care alone.

Tools:

All participants (cases & control) were subjected to the following:

- Non contrast CT brain & ASPECT score measurement
- Cerebral CTA

- DWI if symptoms onset > 6 hours in the thrombectomy group.
- Echocardiography
- Carotid arterial duplex

Clinical interviewing:

- Complete neurological examination at admission, on second day & at discharge
- NIHSS score assessment at admission and at discharge
- mRS score assessment at admission & at 90 d

Thrombectomy group subjected to:

Contact aspiration thrombectomy using Navien cath. First pass recorded then if needed second or third pass. Rescue maneuvers including stent retriever or combined techniques of contact aspiration and stent retriever.

Ethical consideration:

An approval from Research Ethics Committee in Benha faculty of medicine was obtained.

Statistical analysis:

The collected data was revised, coded and tabulated using Statistical package for Social Science (IBM , 2011). Shapiro test, Mean Standard deviation (\pm SD), Student T Test, Mann Whitney Test (U test), The Kruskal-Wallis test, Chi-Square test, Fisher’s exact test, Correlation analysis: and Regression analysis was used. All reported *p* values were two-tailed and *p* <0.05 was considered to be significant (Greenberg et al., 1996; Khothari, 2004; Fischer et al., 2003).

Results:

Characteristics	Thrombectomy (n=31)	Control (n=31)
Age, mean (SD),y	63.15 (9.76)	61.45 (9.89)
Men, No./ (%)	14 (45%)	17 (55%)
Laterality, right	17 (55%)	15 (48.3%)
Hypertension	15 (48.3%)	15 (48.3%)
Diabetes	11 (35%)	11 (35%)
Dyslipidemia	11 (35%)	9 (30%)
Current smoking	8 (25%)	8 (25%)
Ischemic heart disease	6 (20%)	4 (15%)
Previous stroke	3 (10%)	1 (3.2%)
(NIHSS), mean (SD)	17.55 (4)	16.75 (5.2)
ASPECTS, median	8 (6-10)	7 (6-9)
Large artery atherosclerosis	4 (15%)	4 (15%)
Cardio embolic	11 (35%)	12 (40%)
Cryptogenic	15 (48.3%)	14 (45%)

I.V. tPA	9 (30%)	4 (15%)
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Table (1): Demographic data

DSA (occlusion site)	(60 % MCA-M1) (40% distal ICA)
Collateral grade (DSA)	grade [1] (20%), grade [2] (55%), grade [3] (25%)
Time from onset to puncture	mean 5.75 hours, Std. Deviation 1.95
Procedural time	mean 61.2 minutes, Std. Deviation 32.6
Successful revascularization	1 st attempt 8/15 2 nd attempt 4/15 3 rd attempt 3/15
The average time to final revascularization	mean 40 minutes, Std. Deviation 19.8
Aspiration as stand -alone procedure	15 (50%)

Table (2). Procedural data

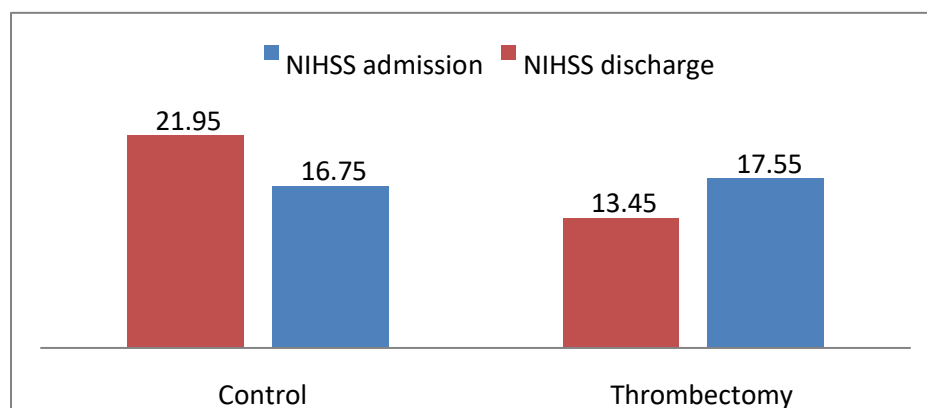


Figure (4): NIHSS score mean at admission and at discharge

Discussion:

Our analysis confirms the benefit of aspiration thrombectomy, based on data from 31 patients, the (Navien) distal access catheter appears to be effective and safe for stroke endovascular therapy with better navigability and tractability into the distal anatomy. However, the major difficulty in accessing the intracranial occlusion in patients with arterial tortuosity. A similar result was noticed with other large-bore aspiration catheters and it is a limitation of the ADAPT compared with the stent retriever thrombectomy (A. S. Turk et al., 2014).

A stent retriever was used in 15/31 (50%) patients of our study, distal access catheter could lead to improve reperfusion rate and reduce procedure duration. The proportion of patients with good mRS outcome who achieved functional independence at 90-days was significantly higher in aspiration group (45%, vs. 10% in the control group; $P = 0.015$), our results revealed to be similar to other studies use SR for thrombectomy; ESCAPE (53.0% thrombectomy group vs. 29.3% in the control group; $P < 0.001$); REVASCAT (43.7% vs. 28.2%; adjusted odds ratio, 2.1; 95% CI, 1.1 to 4.0); SWIFT PRIME (60% vs. 35%, $P < 0.001$) (**Jovin et al., 2015**).

No significant different between both group in mortality (20% vs. 45% in the control , $P = 0.088$) compared to REVASCAT (18.4% in intervention and 15.5% in control $P = 0.60$); EXTEND-IA (9% vs 20% in control) (**B. C. Campbell et al., 2015**).

Nevertheless, several studies have suggested that the proportion of patients who needed rescue therapies was higher among patients who received first-line contact aspiration. A similar result in the ASTER trial found 32.8% of patients treated with contact aspiration received rescue treatment compared to 23.8% in the SR (OR 1.57; $P = 0.05$) (**Lapergue et al., 2017**).

Our analysis also demonstrated that Procedural duration with aspiration only mean was 40 minutes, final revascularization time after the whole procedure 61.2 minutes. Conferring to the ASTER and COMPASS trials procedural time with DA 38 minutes, 25 minutes respectively, contact aspiration resulted in a shorter mean procedural time of 7–10 min compared with SR. Despite this time advantage, contact aspiration was not associated with improved patient outcomes. The potential benefits include reduced procedural duration and reduced treatment cost in cases for which no additional device is needed.

Promising results favor aspiration first pass technique (ADAPT). Efficacy of ADAPT has been endeavored by the recently completed Comparison of Direct Aspiration vs Stent Retriever as a First Approach (COMPASS) trial. This trial establishes no difference in functional outcomes, reperfusion rates (92% aspiration, 89% retrievable stents) and morbidity, and convenes non-inferior functional outcome at 90 days matched with the stent retriever as the first-line technique. This clinical outcome was attained with considerably lower maneuver costs for the aspiration first pass technique. The study supports the usage of the aspiration first pass technique for thrombectomy, and the results might affect recent stroke treatment recommendations (**A. S. Turk et al., 2019**).

In the current study, we reported great effectiveness of the aspiration thrombectomy with an overall final mTICI 2b/3 rates of 90% with a mean procedural time of 61.2minutes. These results when compared to the most common device Solitaire stent retriever since a TICI 2b/3 was observed in 71.1% of patients (**B. C. Campbell et al., 2016**).

The majority of studies comparing direct aspiration versus stent retriever first-line technique demonstrated similar successful (TICI 2b or more) and complete (TICI 3) reperfusion rates, both after the first-line strategy and at the end of the procedure. Successful reperfusion ranged from (42–83%) after first-line DA, and (78–92%) after the whole procedure (Boisseau et al., 2020).

Conclusion:

Our study demonstrates that aspiration thrombectomy by distal access catheters is easily manipulating, safe, and have fewer complications. Aspiration reveals a significant difference regarding functional independence at three months and despite less mortality with aspiration, there is an insignificant difference between both groups.

Limitations:

There were several limitations to our study. While individual data have been collected prospectively, the number of patients was small, and finding contributed to only one center. The angiography was self-assessed and, therefore, the results might be biased to better mTICI scores. Upcoming studies, in the form of multi-center or randomized clinical trials, are necessary for further assessment regarding comparison in safety and efficacy.

Recommendation:

Direct aspiration has been a progressively prevalent option for mechanical thrombectomy, particularly with current developments in catheter technology resulting from the increased suction force, flexibility, tractability, and fewer traumatic tip. Many thrombectomy device trials tend to report mTICI recanalization rates which include both the initial attempt and the use of rescue devices. It is difficult to evaluate the actual efficacy of a certain device. Future studies should include the recanalization rates for the initial device only, before any rescue device has been used, especially if the rescue device is the primary one in the other arm of the study.

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Conflicts of interest:

There are no conflicts of interest.

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