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Efficacy of Asahi Fubuki as a Guiding Catheter for Mechanical Thrombectomy: An Institutional Case Series

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ABSTRACT

SUMMARY: Treatment outcomes of mechanical thrombectomy for acute stroke secondary to large-vessel occlusion in which the Asahi Fubuki was used as a guide catheter were reviewed. Among 154 patients treated with mechanical thrombectomy, the Fubuki was successfully delivered to the cervical ICA in 151 cases (98.1%) and the lesion was successfully crossed in 150 cases (97.4%). Median times to lesion crossing and revascularization were 9 and 19 minutes, respectively.

ABBREVIATION: MT = mechanical thrombectomy

Mechanical thrombectomy (MT) is now an established therapy for treatment of acute ischemic stroke secondary to large-vessel occlusion.¹ Essential to timely MT performance is navigation of a guiding catheter to a location allowing delivery of interventional devices to the site of vessel occlusion, typically the cervical ICA in instances of anterior circulation occlusion. For the past few years at our institution, we have used the Fubuki catheter (Asahi Intecc) as a first-line guide catheter for MT. Herein, we report on the efficacy of the Fubuki when used for this procedure.

MATERIALS AND METHODS

Patient Selection

After institutional review board approval, we retrospectively reviewed the radiology reports of patients undergoing MT for acute ischemic stroke secondary to large-vessel occlusion at our institution between November 2015 and January 2020. Patients were included for analysis if the Fubuki was used as the initial guide catheter for the procedure. The catheter is 90 cm in length, with inner and outer diameters of 2.28 mm (0.090 inches) and 2.70 mm (0.106 inches), respectively. The Fubuki was used in 2 acute stroke cases between 2015 and 2016 and was subsequently used in most mechanical thrombectomies performed at our institution starting in February 2017. Between February 2017 and January 2020, 196 MTs were performed at our institution, and the Fubuki was selected as the guide catheter for 152 (77.6%) of

these procedures. Guide catheters used in the remaining procedures included the 6F Neuron MAX (Penumbra, $n = 22$), 8F FlowGate² (Stryker Neurovascular, $n = 17$), 6F Benchmark (Penumbra, $n = 2$), 6F Shuttle (Cook, $n = 2$), and the Mo.MA proximal balloon protection device (Medtronic, $n = 1$). The FlowGate² and Mo.Ma were preferentially selected for cases of acute stroke secondary to tandem cervical internal carotid artery and intracranial large-vessel occlusions. Two cases were performed via a radial approach, and for both of these cases, the Benchmark guide catheter was used. Otherwise guide catheters were selected according to the physician's preference and not on the basis of specific patient anatomic characteristics.

Patient and Treatment Characteristics

Collected patient demographic information included sex and age at the time of stroke. Anatomic information included laterality and the site of large-vessel occlusion, aortic arch configuration, and the presence or absence of bovine anatomy. The aortic arch configuration was categorized as type I, II, or III based on preprocedural neck CT angiography according to standard criteria.² Treatment characteristics included the method of Fubuki insertion into the femoral artery and type of revascularization device used.

Outcome measures of interest included whether the Fubuki was delivered to the cervical ICA, whether the lesion was crossed with the Fubuki as a guide catheter, whether there was herniation of the Fubuki into the aortic arch during interventional device delivery, and whether crossover to another guide catheter was necessary due to failure of the Fubuki. Whether revascularization was achieved was also noted and characterized as a TICI score of <2b or $\geq 2b$ according to established criteria.³ Times to lesion

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Table 1: Patient characteristics

Characteristics	
No. of Patients	154
Age (mean) (SD) (yr)	67.6 (15.1)
Range	21–94
Sex (No.) (%)	
Female	74 (48.1)
Male	80 (51.9)
Site of large-vessel occlusion (No.) (%)	
M1	65 (42.2)
SC-ICA	29 (18.8)
M2	28 (18.2)
Tandem cervical ICA and M1	19 (12.3)
Basilar artery	7 (4.5)
P1	4 (2.6)
Cervical ICA	2 (1.3)
Laterality (No.) (%) ^a	
Right	63 (42.9)
Left	84 (57.1)
Arch configuration (No.) (%) ^b	
I	84 (62.7)
II	35 (26.1)
III	15 (11.2)
Bovine anatomy (No.) (%) ^b	
No	110 (82.1)
Yes	24 (17.9)

Note:—SC-ICA indicates supraclinoid internal carotid artery.

^a Excludes patients with a basilar occlusion.

^b Preprocedural CTA was not available for 20 patients.

crossed and revascularization in minutes from the time of femoral access were also recorded. We also recorded the incidence of significant access site complications. The incidence of self-limited groin hematomas not requiring imaging evaluation or further intervention was not recorded.

Statistical Analysis

Descriptive statistics for continuous and categorical variables are reported as means and SDs and frequency and percentage, respectively. Descriptive statistics for times to lesion crossed and revascularization are provided as median and range. Predictors of failure to deliver the Fubuki to the cervical ICA were identified using logistic regression analysis. The α level for statistical significance was set at .05. Analyses were performed using commercially available software (JMP; SAS Institute).

RESULTS

Patient Characteristics

There were 154 patients who underwent MT between November 2015 and January 2020 and met the inclusion criteria for analysis. The mean age of patients was 67.6 ± 15.1 years, and a slight majority of patients were men (51.9%). The site of large-vessel occlusion was most often the M1 segment (42.2%), followed in frequency by the internal carotid artery terminus (18.8%). Most large-vessel occlusions occurred on the patient's left side (57.1%). The frequencies of type I, II, and III aortic arch configurations were 62.7%, 26.1%, and 11.2%, respectively, and there were 24 patients with bovine anatomy. A complete summary of patient characteristics is presented in Table 1.

Table 2: Treatment characteristics and outcomes

Characteristics	
Access mode (No.) (%)	
Primary insertion	148 (96.1)
Sheath	6 (3.9)
Fubuki delivered to ICA? (No.) (%)	
Yes	151 (98.1)
No	3 (1.9)
Lesion crossed with Fubuki as guide? (No.) (%)	
Yes	150 (97.4)
No	4 (2.6)
Herniation of Fubuki into aortic arch? (No.) (%)	
Yes	1 (0.6)
No	153 (99.4)
Crossover to another guide catheter? (No.) (%)	
Yes	1 (0.6)
No	153 (99.4)
Mechanism of embolectomy (No.) (%)	
Aspiration	111 (72.1)
Stent retriever	4 (2.6)
Combined aspiration and stent retriever	34 (22.1)
Failure	5 (3.2)
\geq TICI 2b revascularization? (No.) (%)	
Yes	128 (83.1)
No	26 (16.9)
Time to lesion crossed (median) (min)	9
Range	4–102
Time to revascularization (median) (min)	17
Range	3–96
Major access site complications? (No.) (%)	
Yes	3 (1.9)
No	151 (98.1)

Treatment Outcomes

Insertion of the Fubuki directly into the femoral artery was performed in a large majority cases (96.1%). The Fubuki was delivered to the cervical ICA, and the occlusive lesion was successfully crossed with the Fubuki as the guide catheter in 98.1% and 97.4% of cases, respectively. Herniation of the Fubuki into the aortic arch was noted in a single case (0.6%), and crossover to another guide catheter was necessary in 1 case (0.6%). The mechanism of revascularization was most often aspiration (72.1%), followed by aspiration in combination with a stent retriever (22.1%). An interventional device could not be delivered to the site of occlusion in 5 cases (3.2%). TICI 2b revascularization was achieved in 83.1% of cases. Median times to lesion crossed and revascularization were 9 and 17 minutes, respectively (Table 2). For comparison, herniation of the guide catheter from the carotid artery into the aortic arch occurred in 3 of the 22 cases (13.6%) in which the 8F FlowGate² was used and 1 of 17 cases (5.9%) in which the 6F Neuron MAX was used. Procedural outcomes for the other guiding catheters were not included due to the small sample size.

There were 3 instances (1.9%) of major access site complications. One patient experienced a painful femoral pseudoaneurysm that ultimately resolved without intervention. A second patient experienced persistent bleeding from the femoral access site after the procedure, requiring surgical femoral cutdown and repair of the artery. The final patient experienced occlusion of a previously placed femoropopliteal graft, resulting in limb ischemia; this patient also required surgical femoral cutdown and arterial revascularization.

Table 3: Logistic regression identifying predictors of failure to deliver the Fubuki to the ICA

Variable	OR (95% CI)	P Value
Age (yr)	2.04 (0.66–6.36) ^a	.22
Male sex	0.46 (0.04–5.13)	.52
Left-sided occlusion	0.36 (0.03–4.15)	.42
Bovine anatomy	2.35 (0.20–27.00)	.49
Bovine and left-sided occlusion	4.54 (0.38–53.54)	.23
Type III aortic arch	18.15 (1.54–214.16)	.021 ^b

^a Unit odds ratios denoting effect on risk for every decade of age.

^b Statistically significant.

Predictors of failure to deliver the Fubuki to the cervical ICA were determined using logistic regression analysis. A type III aortic arch was the only variable significantly associated with a reduced likelihood of Fubuki delivery to the ICA (OR, 18.15; 95% CI, 1.54–214.16; $P = .021$; Table 3).

DISCUSSION

While previous studies have assessed the efficacy of specific guide catheters for the performance of MT,⁴ to our knowledge, our study is unique in that its focus was on the navigability of the Fubuki as determined by the frequency of failure to deliver the catheter to the cervical ICA. The reported rate of failure in tandem with our relatively low median time to lesion crossed of 9 minutes suggests that the Fubuki is highly efficacious at reaching the cervical ICA in a timely fashion and maintaining a stable position. On logistic regression analysis, a type III aortic arch was the only patient characteristic associated with Fubuki failure, which was unsurprising given previous studies associating complicated arch anatomy with the inability to perform MT.⁵ Nevertheless, as depicted in our representative case, the Fubuki was able to cross relatively tortuous arch anatomy while providing adequate support to complete the MT. In the future, more in-depth anatomic analyses of MT cases may allow improved

quantification of guide catheter performance and facilitate comparison among different catheters.

Limitations

Our study is limited by the single-center, retrospective methodology; thus, it is possible that our results are not completely generalizable. Similar efficacy of the Fubuki should be confirmed in multi-institutional series.

CONCLUSIONS

Our results indicate that the 6F Fubuki is highly effective when used for MT to treat acute ischemic stroke secondary to large-vessel occlusion. These results may serve as a benchmark when assessing the performance of other guide catheters used for this procedure.

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