Summary of Safety and Clinical Performance

for the

SOFIA™ Catheter Family

SSCP22-0003B

MicroVention Europe SARL
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DOCUMENT CHANGE HISTORY

Revision	Date	Description
A	16Dec2022	Initial Document
B	13 November 2023	Updating using content provided in CER21-0000D, addition of SOFIA 88 information

*Annual entries must be included. If a revision is not required, an entry stating such must be added.

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1 SUMMARY OF SAFETY AND CLINICAL PERFORMANCE

This Summary of Safety and Clinical Performance (SSCP) is intended to provide public access to an updated summary of the main aspects of the safety and clinical performance of the device.

The SSCP is not intended to replace the Instructions For Use (IFU) as the main document to ensure the safe use of the device, nor is it intended to provide diagnostic or therapeutic suggestions to intended users or patients.

The following information is intended for users/healthcare professionals.

1.1 Device Identification and General Information

Table 1.1 Device Identification and General Information

Device Names	
Device Trade Name	SOFIA Catheter Family, SOFIA Catheter, SOFIA EX Catheter
EMDN Code and Medical Device Nomenclature	SOFIA Catheter: C0104020207 Peripheral Thrombectomy and Thromboaspiration Systems SOFIA EX Catheter: C0104020204 Peripheral Angiography Guide Catheters
Device Class	Class III
Basic UDI-DI	SOFIA Catheter: 37015174SOFIAJ9 (MVE)
Year when first certificate (CE) was issued for the device	SOFIA Catheter: 2013 SOFIA EX Catheter: 2019
Legal Manufacturer	
Name & Address	MicroVention Europe SARL 30 bis, rue du Vieil Abreuvoir 78100 Saint-Germain-en-Laye, France SRN: FR-MF-000004449
Authorized Representative	
Name & Address	N/A
Authorized Representative SRN	N/A
Notified Body	
Name & Address	DQS Medizinprodukte GmbH
Notified Body Identification Number	0297

1.2 Intended Purpose of the Device

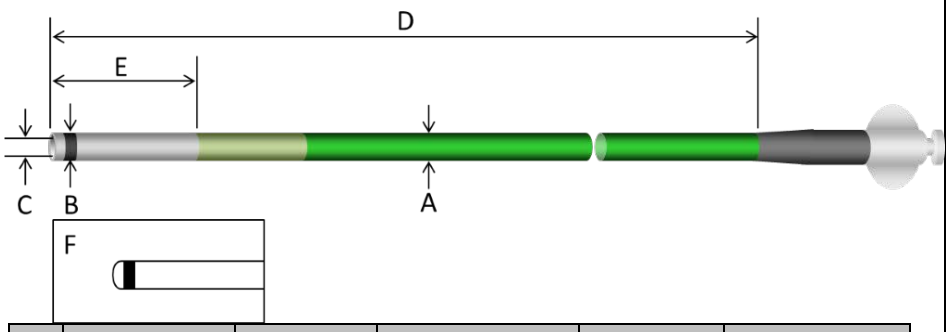
Table 1.2 Intended Use

Intended Purpose	
Intended Purpose	SOFIA Catheters (IFU100160X2, IFU100251X2) The SOFIA Catheter is indicated for general intravascular use, including the neuro and peripheral vasculature. The SOFIA Catheter can be used to facilitate introduction of diagnostic or therapeutic agents. The SOFIA Catheter is not intended for use in coronary arteries. Moreover, the SOFIA Catheter is intended for use in removal/aspiration of emboli and thrombi from selected blood vessels in the arterial system, including the peripheral and neuro vasculatures. SOFIA EX Catheters (IFU100157X2) The SOFIA EX Catheter is indicated for general intravascular use, including the neuro and peripheral vasculature. The SOFIA EX Catheter can be used to facilitate introduction of diagnostic agents or therapeutic devices. The SOFIA EX Catheter is not intended for use in coronary arteries.
Target Population	SOFIA Catheters The intended patient population are those who need introduction of diagnostic or therapeutic agents in the vessels or removal of emboli or thrombi from vessels. The anatomic area of use of SOFIA Catheter is peripheral and neuro vasculature. The device does not apply to the coronary arteries. SOFIA EX Catheters The intended patient population are those who need introduction of diagnostic or therapeutic agents in the vessels. The anatomic area of use of SOFIA EX Catheter is peripheral and neuro vasculature. The device does not apply to the coronary arteries.
Contraindications and/or Limitations	There are no known contraindications. (IFU100160X2, IFU100251X2, IFU100157X2)

1.3 Device Description

Table 1.3 Device Description

Device Description	
Description of the Device	<u>Design and Specifications</u> The SOFIA Catheters are braid plus coil reinforced, single lumen, variable stiffness catheters with a shapeable distal segment. The distal segment is designed to facilitate vessel selection with a hydrophilic coating for navigation through the vasculature. A radiopaque marker is located at the distal end of the catheters for visualization under fluoroscopy (See figure below). The SOFIA EX Catheters are a single-lumen, flexible catheters equipped with a coil and braid reinforcement. The distal segment is designed to facilitate vessel selection with a hydrophilic coating for navigation through the vasculature. A radiopaque marker is located at the distal end of the catheters for visualization under fluoroscopy (See figure below).



	Parameter	SOFIA 5F	SOFIA 6F		SOFIA EX	SOFIA 88
A	Diameter (outer), proximal	0.068 in / 1.7 mm	0.0835 in / 2.1 mm		0.071 in / 1.8 mm	0.108 in / 2.74 mm
B	Diameter (outer), distal	0.067 in / 1.7 mm	0.0825 in / 2.1 mm		0.068 in / 1.7 mm	0.102 in / 2.59 mm
C	Diameter (inner)	0.055 in	0.070 in		0.058 in	0.088 in / 2.2 mm
D	Working length	115 - 125 cm	115 – 135 cm	95 – 105 cm	105, 115 cm	115, 120 cm
E	Distal section	17 cm	19 cm	6 cm	9 cm	14 cm
F	Tip configuration	Straight Shapeable			Straight	Straight

Operating Principles

Intravascularly, the SOFIA Catheter and the guidewire are inserted through a hemostatic valve attached to the femoral sheath using the accessory introducer sheath provided in the device packaging. The introducer sheath is removed when the distal shaft of the aspiration catheter is placed inside the patient body. The aspiration catheter is navigated through the neurovasculature to a location proximal to the lesion. A radiopaque marker located at the distal end of the catheter aids in attaining the desired position. The aspiration vacuum source is attached to the catheter, the catheter is advanced into the proximal end of the thrombus, and suction is initiated. The thrombus is then either aspirated through the catheter, or it becomes stuck at the catheter tip, and the catheter may be withdrawn back into the guide catheter.

Intravascularly, the SOFIA EX Catheter and the guidewire are inserted through a hemostatic valve attached to the femoral sheath using the Introducer Sheath provided in the package. The introducer sheath is removed from the SOFIA EX Catheter once the distal shaft of the SOFIA EX catheter is placed inside the patient body. The radiopaque marker which is located at the distal end of the catheter for visualization under fluoroscopy aids in attaining desired position. In order to navigate through intracranial vasculature, the microcatheter with the guidewire are inserted into the SOFIA EX Catheter. Under fluoroscopic guidance, the SOFIA EX Catheter is advanced or withdrawn over the microcatheter and the guidewire until desired position is attained.

Design Characteristics of the Device	SOFIA Catheters

	The catheter body is constructed with a coil over the inner liner. Braiding covers the coil on the entire length of the catheter. A platinum/iridium alloy radiopaque marker band is located at the distal tip. The catheter outer distal layer is lined with polyolefin elastomer (Engage) and has a hydrophilic coating for lubricious insertion and delivery. The distal lumen is lined with PTFE. The catheter inner diameter is 0.055" (1.4 mm) or 0.070" (1.78 mm). The semi-rigid proximal section transitions to a flexible distal section to facilitate advancement through vessels. A luer fitting on the catheter hub is used for the attachment of accessories. The hub/strain relief provides for the kink resistance from the proximal end. A steam shaping mandrel is provided with the catheter to be used by the physician for tip shaping for SOFIA 5F and 6F Catheters. An introducer sheath is included to introduce the catheter into the y-connector. The SOFIA Catheters are provided sterile and for single use. The catheters are placed in a dispenser tube (HDPE) and is placed on a packaging card (polyethylene) that is provided in a sterile barrier Tyvek pouch and placed in a carton box. The introducer is the accessory that is provided on the packaging card. It is made of polyether block amide (Pebax). The purpose is to provide support when introducing the distal tip of the catheter into the hemostatic valve. Once the SOFIA Catheter distal shaft is placed inside the patient body, the introducer is removed by peeling it away from the system. The introducer sheath is not intended for use inside the patient body. SOFIA EX Catheters The catheter body is constructed with a nitinol coil over the inner lumen liner comprised of polytetrafluoroethylene (PTFE). To provide additional shaft support, a stainless-steel wire braiding has been added over the nitinol coil from the proximal end to the distal end. A platinum/iridium alloy radiopaque marker band is located at the distal tip. This is all covered by an outer layer of varying durometers of materials. The outer layer consists of a range of durometers and lengths of polyolefin, polyurethane (Pellethane) and polyether block amide (Pebax) – distal and proximal, respectively. The most proximal outer shaft section consists of polyamide (Grilamid). The outer surface of the catheter (distal 55-65 cm) is coated with a hydrophilic coating to reduce friction during navigation in the vasculature. A luer fitting on the catheter hub is used for the attachment of accessories. The hub-strain relief provides for kink resistance from the proximal end. An introducer sheath (Pebax) is also included to facilitate the introduction of the catheter into the y-connector. The SOFIA EX Catheters are provided sterile and for single use. The catheters are placed in a dispenser tube (HDPE) and is placed on a packaging card (polyethylene) that is provided in a sterile barrier Tyvek pouch and placed in a carton box. The introducer is the accessory that is provided on the packaging card. It is made of polyether block amide (Pebax). The purpose is to provide support when introducing the distal tip of the catheter into the hemostatic valve. Once the SOFIA EX Catheter distal shaft is placed inside the patient body, the introducer is removed by peeling it away from the system. The introducer sheath is not intended for use inside the patient body.
Previous Generations or Variants, if applicable	The following SOFIA and SOFIA EX Catheter device configurations/variants are CE-Marked and are commercialized in the European Union: • SOFIADistal Access Catheter

	• SOFIASelect Catheter • SOFIAPLUS Catheter • SOFIAFlow PLUS Catheter • SOFIAGuiding Catheter • SOFIAFlow Catheter • SOFIAEX Intracranial Support Catheter
Single use – sterilization method	Single use, EtO Sterilized
Description of Accessories	The SOFIA Catheter comes packaged and sterilized with a steam-shaping mandrel and an introducer sheath. The SOFIA EX Catheter comes packaged and sterilized with an introducer sheath. The SOFIA EX Catheter does not include a steam-shaping mandrel since the tip is not shapeable. (1) The physician may use the steam-shaping mandrel to shape the tip of the catheter. The introducer provides support when introducing the distal tip of the catheter into the hemostatic valve. Once the SOFIA Catheter distal shaft is placed inside the patient body, the introducer is removed by peeling it away from the system. The introducer sheath is not intended for use inside the patient body.
Description of other Devices or Products intended to be used in combination	The SOFIA Catheter is designed to be compatible with standard accessory devices for neurointerventional techniques, which include 6F or larger guiding sheath, ≤0.035" guidewire, and common rotating hemostasis valves (RHVs) and stopcocks. The SOFIA Catheter (not SOFIA EX) is also compatible with Class-I sterile (Is) aspiration accessory kits that provide a vacuum source for aspiration. The kits are manufactured by Merit Medical and distributed by MicroVention. Along with the catheter, these devices provide a vacuum source for the aspiration of emboli. The SOFIA Catheter includes IFUs for usage in conjunction with the Aspiration Tubing Kit and the Aspiration Syringe Kits.

1.4 Risks and Warnings

1.4.1 Residual Risks and Undesirable Effects

Hazards associated with the use of the SOFIA Catheter Family are assessed and risks of the resulting harms are minimized through the use of risk mitigation/control measures. All known foreseeable risks have been evaluated and mitigated.

1.4.2 Warnings and Precautions

1.4.2.1 Warnings

SOFIA Catheters excluding SOFIA 88 Catheter (IFU100160X2)

The SOFIA Catheter should only be used by physicians who have received appropriate training in interventional techniques.

The SOFIA Catheter is provided sterile and non-pyrogenic. Do not use if the packaging is breached or damaged. Do not use after the expiration date provided on the packaging.

Inspect the SOFIA Catheter prior to use. Do not use the device if any damages or irregularities are observed.

Appropriate anti-coagulation and anti-platelet therapy should be administered per standard medical practice.

The SOFIA Catheter should be manipulated under fluoroscopic guidance. Do not advance or withdraw the device when excessive resistance is met until the cause of resistance is determined.

Do not use the SOFIA Catheter with Ethiodol or Lipiodol contrast media or other such contrast media which includes the components of those agents.

Do not use organic solvents as the device may be damaged.

Do not exceed 2070 kPa (300 psi) maximum recommended infusion pressure. Excess pressure may damage the device or injure the patient. Carefully monitor placement of the distal tip when using a power injector to infuse.

Do not make more than 90 degree angle on the Shaping Mandrel. Steaming of the distal tip with more than 90 degree angle may result in damage to the device.

Do not steam the same device more than once, which may result in damage to the device.

Torquing the SOFIA Catheter excessively while kinked may damage the device resulting in separation of the device. Withdraw the entire device (the device, microcatheter, and guidewire) if the device is severely kinked.

The Introducer Sheath is not intended for use inside the patient body. Ensure that the Introducer Sheath is removed from the SOFIA Catheter once the distal shaft of the SOFIA Catheter is placed inside the patient body.

Excessive aspiration with the distal tip of the SOFIA Catheter covered by the vessel wall may cause vessel injury. Carefully investigate location of the distal tip under fluoroscopy prior to aspiration.

Do not attempt to clear the inner lumen of the SOFIA Catheter by infusion while keeping the device in the patient body.

When flow from the lumen stops or becomes stagnant during aspiration, do not attempt to clear the inner lumen of the SOFIA Catheter by infusion while keeping the device in the patient body.

SOFIA 88 Catheter (IFU100251X2)

The SOFIA Flow 88 Aspiration Catheter should only be used by physicians who have received appropriate training in interventional techniques.

The SOFIA Flow 88 Aspiration Catheter is provided sterile and non-pyrogenic. Do not use if the packaging is breached or damaged. Do not use after the expiration date provided on the packaging.

Inspect the SOFIA Flow 88 Aspiration Catheter prior to use. Do not use the device if any damages or irregularities are observed.

Appropriate anti-coagulation and anti-platelet therapy should be administered per standard medical practice.

The SOFIA Flow 88 Aspiration Catheter should be manipulated under fluoroscopic guidance. Do not advance or withdraw the device when excessive resistance is met until the cause of resistance is determined.

Do not use the SOFIA Flow 88 Aspiration Catheter with Ethiodol or Lipiodol contrast media or other such contrast media which includes the components of those agents.

Do not use organic solvents as the device may be damaged.

Do not use automated high-pressure contrast injection equipment with the SOFIA Flow 88 Aspiration Catheter as it may damage the device.

Do not exceed 2070 kPa (300 psi) maximum recommended infusion pressure. Excess pressure may damage the device or injure the patient.

Torquing the SOFIA Flow 88 Aspiration Catheter excessively while kinked may damage the device, resulting in separation of the device. Withdraw the entire device (the device, Compatible Catheter, and guidewire) if the device is severely kinked.

The Introducer Sheath is not intended for use inside the patient body. Ensure that the Introducer Sheath is removed from the SOFIA Flow 88 Aspiration Catheter once the distal shaft of the SOFIA Flow 88 Aspiration Catheter is placed inside the patient body.

Excessive aspiration with the distal tip of the SOFIA Flow 88 Aspiration Catheter covered by the vessel wall may cause vessel injury. Carefully investigate location of the distal tip under fluoroscopy prior to aspiration.

Do not attempt to clear the inner lumen of the SOFIA Flow 88 Aspiration Catheter by infusion while keeping the device in the patient body.

When flow from the lumen stops or becomes stagnant during aspiration, do not attempt to clear the inner lumen of the SOFIA Flow 88 Aspiration Catheter by infusion while keeping the device in the patient body.

SOFIA EX Catheters (IFU100157X2)

The SOFIA EX Catheter should only be used by physicians who have received appropriate training in interventional techniques.

The SOFIA EX Catheter is provided sterile and non-pyrogenic. Do not use if the packaging is breached or damaged. Do not use after the expiration date provided on the packaging.

Inspect the SOFIA EX Catheter prior to use. Do not use the device if any damage or irregularities are observed.

Appropriate anti-coagulation and anti-platelet therapy should be administered per standard medical practice.

The SOFIA EX Catheter must be used under fluoroscopic guidance. Do not advance or withdraw the device when excessive resistance is met until the cause of resistance is determined.

Do not use the SOFIA EX Catheter with Ethiodol or Lipiodol contrast media or other such contrast media which includes the components of those agents.

Do not use organic solvents as the device may be damaged.

Do not exceed 2070 kPa (300 psi) maximum recommended infusion pressure. Excess pressure may damage the device or injure the patient. Carefully monitor placement of the distal tip when using a power injector to infuse.

Torqueing the SOFIA EX Catheter excessively while kinked may damage the device resulting in separation of the device. Withdraw the entire device (the device, microcatheter, and guidewire) if the device is severely kinked.

The Introducer Sheath is not intended for use inside the patient body. Ensure that the Introducer Sheath is removed from the SOFIA EX Catheter once the distal shaft of the SOFIA EX Catheter is placed inside the patient body.

1.4.2.2 Precautions

SOFIA Catheters (IFU100160X2, IFU100251X2)

Exercise care in handling the SOFIA Catheter to reduce the chance of accidental damage.

Verify compatibility of the SOFIA Catheter when using other ancillary devices commonly used in intravascular procedures. The physician must be familiar with percutaneous, intravascular techniques and possible complications associated with the procedure.

Use caution when manipulating the SOFIA Catheter in tortuous vasculature to avoid damage. Avoid advancing or withdrawal against resistance until the cause of resistance is determined.

Presence of calcifications, irregularities, or other devices may damage the SOFIA Catheter and potentially affect its insertion or removal.

Maintain perfusion of heparinized saline for inner lumen of the SOFIA Catheter to prevent thrombus formation.

If removed from the patient, the hydrophilic coating on the SOFIA Catheter should be hydrated with heparinized saline. Do not allow the coating to dry.

SOFIA EX Catheters (IFU100157X2)

Exercise care in handling the SOFIA EX Catheter to reduce the chance of accidental damage.

Verify compatibility of the SOFIA EX Catheter when using other ancillary devices commonly used in intravascular procedures. The physician must be familiar with percutaneous, intravascular techniques and possible complications associated with the procedure.

Use caution when manipulating the SOFIA EX Catheter in tortuous vasculature to avoid damage. Avoid advancing or withdrawal against resistance until the cause of resistance is determined. Torqueing the device against resistance may result in damage to the vessel or device.

Presence of calcifications, irregularities, or other devices may damage the SOFIA EX Catheter and potentially affect its insertion or removal.

Maintain perfusion of heparinized saline for inner lumen of the SOFIA EX Catheter to prevent thrombus formation.

If removed from the patient, the hydrophilic coating on the SOFIA EX Catheter should be hydrated with heparinized saline. Do not allow the coating to dry as this may impact the coating safety and performance.

Avoid pre-soaking devices for long durations when the device is not in use as this may impact the coating safety and performance.

Avoid wiping the device with dry gauze as this may damage the device coating. Avoid excessive wiping of the coated device.

Excessive torqueing of the catheter may cause damage which could result in kinking and possible separation along the catheter shaft. Should the system become severely kinked, withdraw the entire system if this occurs (SOFIA EX catheter, guidewire and catheter sheath introducer).

Limit the exposure to X-ray radiation doses to patients and physicians by using sufficient shielding, reducing fluoroscopy times, and modifying X-ray technical factors, when possible. The risk of X-ray radiation exposure complications may increase as procedure time and number of procedures increase.

1.4.3 Potential Complications / Adverse Effects

SOFIA Catheters (IFU100160X2, IFU100251X2)

Potential complications include, but are not limited to: vessel or aneurysm perforation, vasospasm, hematoma at the site of entry, embolism, ischemia, intracerebral/intracranial hemorrhage, pseudo aneurysm, seizure, stroke, infection, vessel dissection, thrombus formation, and death.

SOFIA EX Catheters (IFU100157X2)

Potential complications include but are not limited to: vessel or aneurysm perforation, vasospasm, hematoma at the site of entry, embolism, ischemia, intracerebral/intracranial hemorrhage, pseudo aneurysm, seizure, stroke, infection, vessel dissection, thrombus formation, and death.

Potential X-ray radiation exposure related adverse events include but are not limited to: alopecia, burns ranging in severity from skin reddening to ulcers, cataracts, delayed neoplasia, tissue necrosis, and risks associated with contrast dye.

1.5 Summary of the Clinical Evaluation and PMCF

1.5.1 Clinical Data

Clinical Data from the Scientific Literature

The clinical evaluation included clinical data from scientific literature from 1 randomized controlled trial, 2 prospective cohort studies, and 15 retrospective studies with a cumulative population of 2283 patients. Publications are listed in Table 1.4 with performance outcomes and safety summarized in Table 1.5 and Table 1.6. In all studies, there were only two complications (1 minor vessel dissection, 1 vasospasm) related to the SOFIA Catheter Family. No other publications reported safety or performance issues associated with the SOFIA Catheter Family.

Table 1.4 Subject Device Publications

Author Year	Title	Study design	Patient Condition	Device Use	n	LOE*
Heit 2018[1]	SOFIA intermediate catheter and the SNAKE technique: safety and efficacy of the Sofia catheter without guidewire or microcatheter construct	Retrospective	AIS, IA, AVM, vasospasm	Access	263	B-NR
O'Cearbhaill 2022[2]	Improving endovascular access to the target vessel for thrombus aspiration –Use of the wedge device to overcome anatomic hurdles	Retrospective	AIS	Access, aspiration, stent retriever	184	B-NR
Suyama 2022[3]	Efficacy of the Flow Re-direction Endoluminal Device for cerebral aneurysms and causes of failed deployment	Retrospective	IA	Access, aspiration, flow diverter, coils	36	C-LD
Chau 2022[4]	Use of the Rocket Technique after Failure of the Direct Aspiration First-Pass Technique in Acute Stroke Thrombectomy	Retrospective	AIS	Access, aspiration	100	B-NR
Colasurdo 2022[5]	SOFIA Nonwire Advancement techniKE 35 Technique: A Minimalist Approach to Stroke Thrombectomy	Retrospective	AIS	Access, aspiration, stent retriever	79	C-LD
Roh 2022[6]	Forced suction thrombectomy in patients with acute ischemic stroke using the SOFIA Plus device	Retrospective	AIS	Access, aspiration	35	C-LD
Bilgin 2021[7]	Direct aspiration thrombectomy experience with the SOFIA 6F catheter in acute ischemic stroke	Retrospective	AIS	Access, aspiration, stent retriever	148	B-NR
Brinjikji 2022[8]	MRS SOFIA: a multicenter retrospective study for use of Sofia for revascularization of acute ischemic stroke	Retrospective	AIS	Access, aspiration, stent retriever	323	B-NR
Choi 2021[9]	Direct aspiration thrombectomy as a first-pass approach for very elderly patients with ischemic stroke	Retrospective	AIS	Access, aspiration	60	C-LD
Fiehler 2019[10]	ERASER. A Thrombectomy Study With Predictive Analytics End Point Stroke	Prospective	AIS	Access, aspiration, stent retriever	80	C-LD

* Level of Evidence (LOE) according to Magid et al., 2020

Kim 2019[11]	Frontline contact aspiration thrombectomy using SOFIA catheter for acute ischemic stroke: period-to-period comparison with Penumbra catheter	Retrospective	AIS	Access, aspiration, stent retriever	99	C-LD
Le Blanc 2019[12]	Effects of Intermediate Catheter Evolution on Technical Outcome of Mechanical Thrombectomy—A Comparison of the Performance of Two Distal Access Catheters in Mechanical Thrombectomy of Acute Ischemic Stroke	Retrospective	AIS	Access, aspiration, stent retriever	116	B-NR
Marnat 2019[13]	First-Line Sofia Aspiration Thrombectomy Approach within the Endovascular Treatment of Ischemic Stroke Multicentric Registry: Efficacy, Safety, and Predictive Factors of Success	Retrospective	AIS	Access, aspiration, stent retriever	296	B-NR
Nouri 2019[14]	Real-world thrombectomy using the SOFIA catheter.	Prospective	AIS	Access, aspiration, stent retriever	140	B-NR
Romano 2019[15]	Efficacy of ADAPT with large-bore reperfusion catheter in anterior circulation acute ischemic stroke: a multicentric Italian experience	Retrospective	AIS	Access, aspiration	184	B-NR
Shallwani 2018[16]	Safety and Efficacy of the Sofia (6F) PLUS Distal Access Reperfusion Catheter in the Endovascular Treatment of Acute Ischemic Stroke	Retrospective	AIS	Access, aspiration, stent retriever	41	C-LD
Wessel 2020[17]	Thrombectomy for acute ischemic stroke with the new Sofia 6-French PLUS distal access reperfusion catheter: A single-center experience	Retrospective	AIS	Access, aspiration, stent retriever	54	C-LD
White 2020[18]	Evaluation of stroke thrombectomy including patients where IV thrombolysis is contraindicated or has failed: a randomized trial of two novel thrombectomy devices	RCT	AIS	Access, aspiration, stent retriever	45	B-R

Table 1.5 Subject Device Published Performance Outcomes

Author Year	Technical success	TICI (2b-3)	First-pass effect	NIHSS (median)	mRS (0-2)
Bilgin 2021	89.1% (132/148) Overall 87.8% (130/148) SOFIA alone	89.1% (132/148) Overall 69.2% (90/130) Aspiration only	ND	14 @ baseline 4 @ discharge	49.3% (73/148) @ 3 mo
Brinjikji 2022	93.5% (302/323)	93.5% (302/323) Overall	69.7% (225/322)	15.1 @ baseline 9.2 @ 24 h	55.7% (163/291) @ 3 mo
Chau 2022	99% (99/100)	90% (90/100) Aspiration	72% (72/100)	17.5 @ baseline 4.5 @ discharge	56% (56/100) @ 3 mo
Choi 2021	71.7% (43/55)	71.7% (43/55) Aspiration only	55% (33/60)	11.4 @ baseline 9.1 @ post op	36.7% (22/60) @ discharge 55.0% (33/60) @ 3 mo
Colasurdo 2022	84% (66/79)	87% (69/79) Overall	47% (37/79)	18 @ baseline	ND
Fiehler 2019	95% (76/80)	95% (76/80) Overall	ND		70% (48/69) @ 3 mo
Heit 2018	96% (293/305)	N/A	N/A		
Kim 2019	92.9% (91/99)	92.9% (91/99) Overall	39.4% (39/99)	16 @ baseline 8 @ 1 d 2 @ 7 d	58.6% (58/99) @ 3 mo
Le Blanc 2019	69.9% (39/56)	69.9% (39/56) Aspiration only	ND	15.1 @ baseline	36.8% (35/95) @ 3 mo
Marnat 2019	86.1% (255/296)	86.1% (255/296) Overall	24.2% (71/296)	16 @ baseline	43% (122/296)

Nouri 2019	98.0% (137/140) positioning	82.1% (115/140) Overall	31.4% (44/140)	19 @ baseline	34.3% (48/140) @ 3 mo
O'Cearbhaill 2022	75.5% (117/155) without wedge 97.4% (37/38) with wedge	97.3% (36/37) Overall 100% (27/27) Aspiration only 90% (9/10) with SR	70.3% (19/27) Aspiration 20% (1/5) SR	17.3 @ baseline 11.5 @ 24 h 6.9 @ 5 d	ND
Roh 2022	100% (35/35)	100% (35/35) Overall	45.7% (16/35)	12.1 @ baseline 7.6 @ discharge	54.3% (19/35) @ 3 mo overall 76.2 (16/21) aspiration only 21.4% (3/14) SR
Romano 2019	73.9% (136/184)	73.9% (136/184) Aspiration only	ND	ND	ND
Shallwani 2018	92.7% (38/41) positioning	90.2% (37/41) Overall 73.3% (11/15) Aspiration only	ND	16.5 @ baseline 8.5 @ 7 d	ND
Suyama 2022	92.1% (35/38)	NA	NA	ND	ND
Wessel 2020	94% (51/54) positioning	87% (47/54) Overall	39% (21/54)	16.0 @ baseline 9.0 @ discharge	41% (18/54) @ 3 mo
White 2020	95.6% (43/45) access artery	72% (31/43) Overall	ND	18 @ baseline	44% (16/37) @ 3 mo 40% (14/37) @ 12 mo

Table 1.6 Subject Device Published Safety Outcomes

Author Year	ICH/sICH	Vessel dissection/ rupture/ perforation	Emboli downstream/ new territory	Other AEs	Mortality	Complications related to SOFIA
Bilgin 2021	5.4% (8/148) sICH	2% (3/148) Dissection	5.4% (8/148)	None	14.1% (21/148)	None
Brinjikji 2022	13.7% (44/321) ICH 5.6% (18/321) SAH	0.3% (1) Dissection 1.9% (6) Perforation	1.5% (5)	None	ND	None
Chau 2022	37% (37/100) ICH 10% (10/100) sICH	0	3% (3/100)	None	ND	Not specified
Choi 2021	Not specified	0	Not specified	Complication related to the procedure (embolization to new territories, ICH, SAH): 10.0 % (6/60) Hemorrhagic transformation of infarcted lesion: 61.7% (37/60)	6.7% (4/60)	None
Colasurdo 2022	0	1.2% (1/79) Dissection	0	None	ND	1 vessel dissection (minor)
Fiehler 2019	ND	ND	ND	ND	9% (7/80)	ND
Heit 2018	0	0	0	Vasospasm: 1.9% (5/263)	ND	1 vasospasm

Kim 2019	7% (7/99) Overall 4% (4/99) parenchymal hematoma 1% (1/99) SAH 2% (2/99) mixed 3% (3/99) sICH	ND	2.0% (2/99)	11.1% (11/99) emboli downstream	6.1% (6/99)	Not specified
Le Blanc 2019	0	0 Dissection 1.7% (2/166) Perforation	2.6% (3/116)	None	ND	Not specified
Marnat 2019	44.6% (115/296) ICH @ 24h 12% (21) parenchymal hematoma 6.2% (16) sICH	1.4% (4/296) Perforation 1.4% (4/296) Dissection	4.7% (14/296)	2% (6/296) vasospasm	22.9% (65/296)	Not specified
Nouri 2019	7.1% (10/136) sICH	2.1% (3/140) Dissection 1.4% (2/140) Perforation	4.3% (6/140)	Groin hematoma: 7.9% (11/140) Fistula: 0.1% (1/140)	25.0% (35/140)	None
O Cearbhaill 2022	0	0	0	Groin hematoma: 3.7% (1/27)	ND	Not specified
Roh 2022	11.4% (4/35) SAH Overall 4.7% (1/21) Aspiration 21.4% (3/14) SR	0	14.3% (5/35) Overall 19.0% (4/21) Aspiration 7.1% (1/14) SR	None	6% (2/35) unrelated	Not specified
Romano 2019	ND	ND	ND	ND	ND	ND
Shallwani 2018	0	2.4% (1/41) Dissection	4.9% (2/41)	Vasospasm: 9.8% (4/41) Contrast extravasation: 4.9% (2/41) Retroperioneal hematoma/aneurysm formation: 2.1% (1/41)	0	None
Suyama 2022	0	0	0	Fistula: 2.6% (1/28) 2.6% (1/28) ischemic infraction	0	Not specified
Wessel 2020	0	1.9% (1/54) neck hemorrhage	0	Infraction: 1.9% (1/54)	18% (8/54)	None
White 2020	4.4% (2/45) rupture/SAH	4.4% (2/45) rupture/SAH	0	Puncture site related: 4.4% (2/45)	9% (4/37)	Not specified

Clinical Data from Post-Market Surveillance

Over the past 5 years, the SOFIA Catheter Family had a complaint rate of 0.18%, and a rate of complaints reportable to governmental authorities of <0.01%.

1.5.2 Clinical Performance and Safety

The devices within the SOFIA Catheter Family may be used as access devices to support and advance a primary treatment device to the target vascular anatomy. Thus, clinical outcomes from procedures in which the SOFIA catheters are in this way are generally difficult to directly attribute

to the performance of the SOFIA catheters other than the rates of technical success (e.g., successful navigation/placement of a device). For example, in the treatment of an intracranial aneurysm in which a SOFIA catheter may be used an intermediate catheter for the placement of a flow diverter, outcomes that can be attributed to the SOFIA catheter are limited to technical or device deployment success. In addition, while clinical outcomes for these procedures are mainly attributed to the primary treatment device, successful treatment of a condition can also infer performance of the access devices.

The SOFIA Catheters can also be used as aspiration devices to remove the emboli or thrombi from the vessels in aspiration-only procedures or in combination with stent retrievers. Endovascular treatment of AIS with the SOFIA Catheter can be lifesaving and result in benefits such as restoration of blood flow to previously occluded intracranial vessel segments, improved neurological outcomes immediately post-procedure, and improved functional independence and reduced disability. Successful treatment of conditions avoids some risks and complications associated with these conditions. Clinical benefits to the patients, including recanalization of affected vasculature (TICI 2b-3), improvement of NIHSS, and good clinical outcomes (mRS 0-2). Clinical benefits of the SOFIA Catheter when used in this way are substantial, especially when compared against the risks and complications associated with the treated conditions.

The clinical evaluation report provides clinical data for the SOFIA Catheter Family, when used as an access device or as an aspiration device, alone or in combination with stent retrievers or other devices, to remove thrombi or emboli from vessels. Clinical data on the SOFIA Catheter Family from the scientific literature have been summarized from 18 studies with a total population of 2283 patients. The published clinical data show high rates of technical success (73.9-100%), recanalization (TICI 2b-3 72-100%), and good clinical outcomes at 90 days (mRS 0-2 34-70%) with NIHSS shifts from 11-18 to 2-9.2, which are comparable to the published literature for the SOTA for similar devices. Published safety outcomes for the SOFIA Catheter Family, include rates of hemorrhagic complication (ICH 0-44.6%, sICH 0-10.0%, and SAH 0-11.4%), vessel dissection/rupture/perforation (0-2%), emboli in new territory (0-14.3%), vasospasm (0-9.8%), and low mortality (0-25%).

1.5.3 Post-Market Clinical Follow-up

Two post-market clinical investigations are currently on-going for the SOFIA Catheter Family, including 1 investigator-initiated trial (SESAME) and 1 sponsor-initiated study (SOFAST).

Details are provided in Table 1.7 and Table 1.8.

Table 1.7 SESAME Study

Number	NCT03417349

Study Title	Safety and Effectiveness of SOFIA/SOFIA PLUS Catheter for Direct Aspiration in Acute Ischemic Stroke (SESAME)
Study Type	Observational
Study Status	Start Date: 01 October 2017 Completion Date: 15 March 2022
Enrollment	250 participants
Study Population	Patients who are at least 18 years of age presenting with an acute ischemic event in the anterior cerebral circulation that can be treated within 6 hours from AIS symptom onset. Those eligible to be treated with SOFIA/ SOFIA PLUS Catheter will be enrolled after having signed an informed consent form (or having one signed on his or her behalf by a legally authorized representative).
Inclusion Criteria	1. Participant is ≥ 18 2. Demonstrated occlusion of the distal intracranial carotid artery, middle cerebral artery (M1 or M2) or anterior cerebral artery (A1 or A2) proven by CT and/or MRI 3. NIHSS ≥ 2 and ≤ 30 at screening 4. Start of the thrombectomy procedure within 6 hours of the onset of stroke symptoms 5. Pre event mRS ≤1 6. Patient or patient's legally authorized representative has received information about data collection and has signed and dated an Informed Consent Form
Exclusion Criteria	Exclusion Criteria: 1. Patient is more than 6 hours from symptom onset 2. Rapidly improving neurologic examination 3. Evidence of cerebral ischemia in the posterior circulation 4. Severe unilateral or bilateral carotid artery stenosis requiring stent treatment 5. Presence of an existing or pre-existing large territory infarction 6. Absent femoral pulses 7. Excessive vascular tortuosity that will likely result in unstable access 8. Pregnancy; if a woman is of child-bearing potential a urine or serum beta HCG test is positive 9. Known contrast product allergy 10. Patient has a severe or fatal comorbidity that will likely prevent improvement or follow up or that will render the procedure unlikely to benefit the patient 11. Evidence of intracranial hemorrhage (SAH, ICH, etc.)
	Imaging exclusion criteria: • Significant mass effect with midline shift or intracranial tumor • Baseline non-contrast CT or DWI MRI evidence of a moderate/large core defined as extensive early ischemic changes of Alberta Stroke Program Early CT score (ASPECTS) 0-5
Conditions	• Cerebrovascular Stroke • Stroke, Acute • Cerebral Stroke
Interventions	Device: SOFIA Catheter

	The SOFIA/ SOFIA PLUS Catheter will be used in removal/aspiration of emboli and thrombi following the CE marked Instructions For Use. Enrollment into the study does not change the routine care at the site provided to the patient requiring mechanical thrombectomy treatment. Other Names: • MicroVention - SOFIA Catheter • MicroVention - SOFIA PLUS Catheter
Primary Outcome Measures	Dichotomization of patients into good functional outcome defined as a modified Rankin Score (mRS) ≤ 2 and bad functional outcome defined as mRS >2
Secondary Outcome Measures	1. Safety - neurological [Time Frame: Prior to discharge / approximated 3-7 days] Occurrence of major neurological events (stroke, intracranial hemorrhage, intracerebral hemorrhage, etc. 2. Safety - procedural [Time Frame: 90 days] Devices and procedure related adverse events within 90 days of follow up 3. ENT [Time Frame: Intra-procedure] Infarct in a New Territory After Treatment Administration as seen on final control angiogram at the end of the procedure 4. sICH [Time Frame: 24 hours] Occurrence of symptomatic intracranial hemorrhage (sICH) within 24 hours 5. Vessel damage [Time Frame: Intra-procedure] Occurrence of intracranial vessel damage at the end of the procedure as seen on final control angiogram at the end of the procedure 6. Recanalization - Aspiration [Time Frame: Intra-procedure] Proportion of patients having complete recanalization (TICI≥ 2b) just after first line aspiration treatment as seen on control angiogram 7. Recanalization - Other [Time Frame: Intra-procedure] Proportion of patients having complete recanalization (TICI ≥ 2b) af-ter thrombectomy using an additional device as seen on control angiogram 8. Time to recanalization- Aspiration [Time Frame: Intra-procedure] Time from groin puncture to complete recanalization (TICI ≥ 2b) in patients after first line aspiration treatment as seen on control angiogram 9. Time to recanalization- Other [Time Frame: Intra-procedure] Time from groin puncture to complete recanalization (TICI ≥ 2b) in patients after thrombectomy using an additional device as seen on control angiogram 10. Time to angio [Time Frame: Intra-procedure] Time from CT-scan/MRI at the institution to groin access 11. Symptom onset [Time Frame: Pre-procedure] Time from symptom onset to CT-scan/MRI 12. Neurological outcome 24 [Time Frame: 24 hours] National Institutes of Health Stroke Scale (NIHSS) score at 24 hours, total and subscale scores 13. Neurological outcome discharge [Time Frame: Discharge / approximately 3-7

	days] National Institutes of Health Stroke Scale (NIHSS) score at discharge, total and subscale scores 14. Neurological outcome 90 days [Time Frame: 90 days / +/- 14 days] National Institutes of Health Stroke Scale (NIHSS) score at 90 days, total and subscale scores 15. Degree of disability - discharge [Time Frame: Discharge/ approximately 3- 7 days] modified Rankin Score at discharge, total score 16. Degree of disability - 90d [Time Frame: 90 days / +/- 14 days] modified Rankin Score at 90 day follow-up, total score 17. Quality of Life at 90 days [Time Frame: 90 days / +/- 14 days] Quality of Life at 90 days assessed via PROMIS Scale v1.2 - Global Health, total score 18. Imaging [Time Frame: 24 hours] Difference of Alberta stroke program early CT score (ASPECTs) scores in CT/MRI pretreatment vs. 24h, total scores 19. Imaging - perfusion [Time Frame: 24 hours] In the subgroup of patients with additional perfusion CT (as per local standard of care): volume of saved brain tissue determined by predictive modeling 20. Health Economics -device [Time Frame: Intra-procedure] Device costs (standardized cost of all devices as well as human resources and medication used during index procedure) 21. Health Economics - hospital [Time Frame: Discharge / approximately 3-7 days] Hospital length of stay
Locations	Austria, France, Germany, Italy, Netherlands
Sponsor(s)	Dr. Markus Alfred Möhlenbruch Collaborator: MicroVention-Terumo, Inc. and Eppdata Hamburg
Progress	This study has been completed. Findings from this study will be made available at the time of publication.

Table 1.8 SOFAST Study

Number	NCT04451525
Study Title	SOFIA Aspiration System as First Line Technique (SOFAST)
Study Type	Prospective multi-center, single arm, observational, Real World Evidence (RWE) post-market study

Study Status	Start Date: 15 July 2025 Estimated Completion Date: December 2025
Enrollment	250 participants
Study Population	Adults presenting with AIS in the anterior circulation that can be treated using the direct aspiration as first line treatment technique for mechanical thrombectomy.
Inclusion Criteria	Inclusion Criteria: • Patient is ≥ 21 and < 80 years of age. • Patient has a pre-morbid mRS ≤ 1. • Neuroimaging (CT/CTA and/or MR/MRA collected at no more than 60 minutes pre-treatment) demonstrates large vessel proximal occlusion (distal ICA through MCA bifurcation). • Patient has an NIHSS score ≥ 5 at time of intervention. • Symptom onset is within 6 hours of when groin puncture can be achieved. • Patient will undergo treatment via femoral access and the decision to use femoral access has been made by the treating physician outside the context of the SOFAST study and prior to study enrollment. • Patient will be treated using the direct aspiration as first line treatment technique and the decision to use this technique and the study device has been made by the treating physician outside the context of the SOFAST study and prior to study enrollment. • Patient or patient's legally authorized representative (LAR) has provided written informed consent. • Patient is considered by the treating physician to be available for and able to complete all follow-up visits with a trained site investigator.
Exclusion Criteria	Exclusion Criteria: • Inability to obtain written informed consent. • Patient is < 21 or ≥ 85 years of age. • Patient has a pre-morbid mRS ≥ 2.
	• More than 8 hours have passed since symptom onset. • Severe unilateral or bilateral carotid artery stenosis or dissection requiring stent treatment. • Presence of a pre-existing large territory infarction. • Absent femoral pulses or other condition preventing femoral access. • Patient has vascular anatomy/tortuosity or other vascular disease preventing access to the target occlusion or that will likely result in unstable access. • Patient is pregnant. • Known or suspected pre-existing/chronic large vessel occlusion in the symptomatic territory. • Patient has known, untreatable hypersensitivity to contrast dye, iodine or any component of the treatment device that cannot be medically controlled. • The intracranial occlusion is suspected to be chronic based past imaging, clinical history, or clinical judgment. • Patient has a severe or life-threatening comorbidity that could confound study results, or that will render the procedure unlikely to benefit the patient. • Patient is unable to complete scheduled follow-up assessments due to comorbidities, geographical limitations, or a life expectancy of less than 3 months. • Patient is enrolled in another device or drug study in which participation could confound study results. • Imaging (CT or MR) exclusion criteria: a. Presence of intracerebral hemorrhage as evidenced on initial

	imaging b. Ischemic changes in the posterior circulation territories (including the vertebra-basilar and posterior cerebral arteries) c. Significant mass effect with midline shift d. Evidence of intracranial tumor e. Baseline ischemic core lesion >50 cc f. Involvement of > 1/3 of the middle cerebral artery territory g. ASPECTS <6 (hemispheric sulcal effacement and/or loss of grey- white differentiation alone are not contraindications for treatment)
Interventions	Device: SOFIA Flow Plus 6F Aspiration Catheter with the Gomco 405 Aspiration Pump and Tubing Kit Patient will be treated using the direct aspiration as first line treatment technique.
Primary Outcome Measures	Proportion of subjects achieving mTICI ≥ 2b revascularization based on independent core lab assessment [Time Frame: During the procedure]
Secondary Outcome Measures	1. Proportion of subjects with good functional outcome defined as mRS ≤ 2 [Time Frame: 90 days] 2. Occurrence of procedure related serious adverse events [Time Frame: During the procedure through study completion at 90 days] 3. Occurrence of sICH within 24 hours [Time Frame: 24 hours Post-operative] 4. Occurrence of embolization to new territories (ENT) [Time Frame: During the procedure] 5. Presence of vasospasm involving the accessed vascular tree [Time Frame: During the procedure through 24 hours post-operative] 6. Mortality at day 90 [Time Frame: 90 days post-procedure] 7. Proportion of subjects achieving mTICI ≥ 2b revascularization after first line aspiration treatment [Time Frame: During the procedure] 8. Number of passes to achieve mTICI ≥ 2b revascularization with first line aspiration treatment [Time Frame: During the procedure] 9. Proportion of subjects achieving mTICI ≥ 2b revascularization after first aspiration pass [Time Frame: During the procedure] 10. Time from groin puncture to initial contact of clot with aspiration catheter [Time Frame: During the procedure] 11. Time from groin puncture to achieve mTICI ≥ 2b using first line aspiration treatment [Time Frame: During the procedure]
Locations	United States
Sponsor(s)	MicroVention-Terumo, Inc.
Progress	Cohort I is approaching database lock. Cohort II is enrolling; currently 24 subjects are enrolled.

1.6 Possible Diagnostic or Therapeutic Alternatives

1.6.1 Treatment Options and Interventions

Treatment for AIS is aimed at restoring blood flow and reperfusion ischemic tissue, halting progression of infarction, and preventing recurrence.[19,20] Restoration is achieved medically using a thrombolytic drug or by intervention with endovascular treatment (EVT), or both. Approximately

25% of all ischemic stroke patients are eligible for medical thrombolysis, and 10-12% are eligible for EVT due to critical time window. The number of patients who can benefit from these treatments continues to increase as new studies demonstrate that not just time since stroke onset but also collateral circulation influences outcome.[21,22]

1.6.2 Thrombolytic Drugs

Treatment options for AIS include intravenous thrombolysis (IVT) using recombined tissue plasminogen activator (tPA) such as alteplase or tenecteplase, or intra-arterial (IA) thrombolysis using urokinase[22-26]. IVT has been reported to be effective in improving functional outcomes after ischemic stroke up to 4.5-9 hours after symptom onset The US Food and Drug Administration (FDA) has only approved alteplase for use within 3 hours of stroke onset, but regulatory agencies in most other countries, including those in the European Union, have approved its administration within 4.5 hours of stroke onset.[20] The FDA approval was based upon the results of the 1995 National Institute of Neurological Disorders and Stroke (NINDS) tPA trial. This trial was able to show a significant improvement in functional outcome at 90 days when tPA was given 3 hours of symptom onset. The European Cooperative Acute Stroke Studies (ECASS-III) evaluating the efficacy of IV alteplase within 3 and 4.5 hours after symptom onset and pooled analysis of multiple trials testing IV alteplase within various time windows support the value of IVT up to 4.5 hours after symptom onset.[27,28] Although tPA remains the mainstay of AIS therapy, it has several limitations, including a short half-life, low recanalization rate of 30-40% for proximal occlusions and of <5% for distal ICA occlusion.[29]

Drawback for the use of intravenous thrombolytics include low recanalization rates and poor clinical outcomes in patients with LVO. These patients are less likely to experience quick recanalization, due to poor IV thrombolysis.[11] Also, the use of intravenous thrombolytics may delay the time to initiating thrombectomy and may result in thrombus migration. The use of intravenous thrombolytics may also increase the risk of sICH (2-7%), especially in patients taking antiplatelet drugs or with a known coagulopathy, resulting in serious IVT complications.[22,23,30] Newer thrombolytic drugs, like tenecteplase, are promising alternatives, having similar efficacy to alteplase, but a better safety profile, due to its lower risk of hemorrhagic transformation and higher fibrin selectivity.[22,23,25,26,31]

1.6.3 Endovascular treatment

Although IV-tPA has been shown to be effective, its effectiveness may diminish with more proximal or larger occlusions. The low success of tPA to achieve recanalization of LVO prompted development of endovascular treatment. This was possible due to technological advances in endovascular surgery with better catheters to enable more distal access and better stent retrievers to safely remove the thrombi from brain vessels. The benefit of endovascular mechanical thrombectomy (EMT) for AIS caused by emergent LVO in the anterior circulation has been uniformly reported by RCT and meta-analyses up to 24 hours after last known well.[23,24,30,32] In mechanical thrombectomy, devices that remove blood clots from a large cerebral artery and to restore blood flow comprise mostly 2 types: stent retrievers and aspiration catheters.[33] Those

techniques can be used in conjunction with a proximal flow control by balloon guide catheters (BGC) temporally inflated in the parent vessel. The main goal of this technique is to limit adverse emboli in new-initially unaffected-territories (ENT). The benefits of endovascular treatment were observed irrespective of a patient's age, their NIH Stroke Scale (NIHSS) score, or whether they received intravenous thrombolysis. Compared to medical therapy with tPA alone, patients who received EVT were more likely to have a good functional outcome (typically mRS 0-2), without an increased rate of symptomatic intracerebral hemorrhage (sICH) or mortality.[34] The advances in AIS treatment with EVT have demonstrated significant reduction in stroke morbidity and mortality.[35]

1.6.3.1 Stent Retrievers

Stent retrievers (SR) are self-expandable wire mesh tube delivered by a microcatheter, intended to remove the clot that is trapped and withdrawn by pulling.[33] The use of stent retrievers to perform mechanical thrombectomy has become a rapidly emerging therapy for the treatment of AIS.[34] Six RCTs (MR CLEAN, EXTEND-IA, ESCAPE, REVASCAT, SWIFT PRIME and THRACE) confirmed the benefits of using endovascular thrombectomy on the clinical outcome of patients with stroke with LVO.[36] The use of stent retrievers in the trials led to recanalization rates of between 59% and 88%. The trials showed also that the likelihood of a good outcome increased with better recanalization. The highest recanalization rates were achieved in SWIFT PRIME (88%) and EXTEND-IA (86%), correlating with the high rates of good clinical outcomes (mRS 0-2) seen in these trials (60% and 71%, respectively). The lowest recanalization rate was in MR CLEAN at 59% with a favorable clinical outcome occurring in only 33% of the patients.[37] All 6 trials provided strong evidence to support the use of thrombectomy that is initiated within 6 h of stroke onset, prompting worldwide changes in the guidelines for management of acute stroke by endovascular treatment. The recent publication of the Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo® (DAWN)/Endovascular Therapy Following Imaging Evaluation for Ischemic Stroke (DEFUSE 3) trials extended the time window to patients with wake-up strokes and those presenting beyond 6 hours from symptoms' onset up to 16-24 hours from last time seen well.[33]

Effective reperfusion with stent retriever technology, careful patient selection using perfusion imaging, and careful use of anesthetic technique affect outcome. According to the 2019 AHA/American Stroke Association Guidelines for Early Management of Patients With Acute Ischemic Stroke, patients with AIS should undergo mechanical thrombectomy with a stent retriever if their pre-stroke mRS is 0-1; if the occlusion is located in the ICA/MCA M1 segment; if they are at least 18 years of age; if their NIHSS score is ≥6; if their Alberta Stroke Program Early Computed Tomography (ASPECT) score is ≥6; and if treatment can be started within 6 hours of symptom onset.[28] Mechanical thrombectomy is also recommended in patients with AIS and LVO in the anterior circulation within 6 to 16 hours of last known normal who meet other eligibility criteria from the diffusion weighted imaging (DWI) or CTP Assessment with Clinical Mismatch in the Triage of DAWN/DEFUSE 3 trials. The guidelines further note that mechanical

thrombectomy may be reasonable in patients with AIS and LVO in the anterior circulation within 6-24 hours of last known normal who meet other eligibility criteria from the DAWN/DEFUSE 3 trials.[28]

1.6.3.2 Aspiration

Despite the positive results of the stent retrievers with successful recanalization, there are some vessel occlusions and thrombi that are resistant to this technique even after repeated recanalization attempts. These vessel occlusions include cases of terminal ICA occlusions. Moreover "hard" thrombi in other locations, such as the MCA, can also been resistant to the stent retriever technique. For these cases, direct aspiration of the thrombus can be used as an alternative technique.[37] Mechanical thrombectomy with aspiration, uses large bore aspiration catheters guided to the proximal end of the clot put under negative pressure using an electric pump or manual suction with a syringe to retrieve the clot (the thrombus is either aspirated through the catheter or stuck at the tip and retrieved with the aspiration catheter).[33] During aspiration thrombectomy, aspiration catheters are placed through a guide catheter and advanced coaxially over a microcatheter or microwire to the occluded vessel. The microcatheter or microwire is advanced through the clot, and the aspiration catheter is advanced into the proximal clot. The microwire and microcatheter are then removed, and suction is applied manually with a large-volume syringe or an aspiration pump.[38]

The Penumbra System® was developed to remove thrombus using aspiration in patients with AIS. Its reported advantages include continuous aspiration and extraction of thrombi, aspiration beginning at the thrombus interface (eliminating the need to catheterize distal to the thrombus), and the availability of different sizes of reperfusion catheters.[33] The THERAPY trial compared aspiration thrombectomy with Penumbra System after intravenous alteplase to medical treatment with alteplase alone. Although the trial was underpowered because of early termination from loss of equipoise, trends were seen in superior clinical outcomes for aspiration thrombectomy.[39] The Contact Aspiration vs. Stent Retriever for Successful Revascularization (ASTER) trial compared the standard stent retriever technique with contact aspiration technique as a first-line endovascular treatment among patients with AIS and LVO. The trial failed to demonstrate this superiority of direct aspiration first pass technique (ADAPT) over stent retriever, as recanalization (TICI 2b-3) was achieved in 85.4% of patients in the aspiration group versus in 86.2% in the SR group. Recanalization (TICI 2b-3) after first-line approach was achieved in 63% of patients in the aspiration group versus in 67.7% in the SR group. The functional independence (mRS score <3) was reached in 45.3% of patients undergoing aspiration versus 50% in the SR group.[33] A meta-analysis of published studies compared direct aspiration versus SR for efficacy and safety as a front-line endovascular procedure. There was no significant difference between the direct aspiration group and the SR group in rate of successful recanalization (summary odds ratio [OR], 0.86 [95% confidence interval (CI), 0.45– 1.52]; P=.60), but better functional outcomes in the direct aspiration group at 3 months defined as a mRS score of 0-2 (OR, 0.77; 95% CI, 0.66–0.97; P=.03). Furthermore, the direct aspiration patients compared with the SR patients had a tendency of

shorter procedural time (Mean difference [MD], -8.77 [95% CI, from-18.90 to 1.37]; P=.09). Finally, there were less adverse events especially in sICH (OR, 0.56; 95% CI, 0.33–0.98; P=.04) and embolization to a new territory (ENT) (OR, 0.49; 95% CI, 0.28–0.84; P=.01) in the direct aspiration group when compared with the SR group, although no difference between them in the rate of any ICH (OR, 0.81; 95% CI, 0.41–1.60; P=.54).[40] Another meta-analysis by Gory et al. included 1378 patients treated with ADAPT from 16 articles. Half of the patients (51%) were pre-treated with IV-tPA. Overall, successful recanalization (TICI 2b-3) was reported in 89% of patients, of which 50% of patients attained functional independence (mRS 0-2) at 90 days. Additionally, at 90 days, the mortality rate was 15%, while sICH was reported in 5% of patients. The ADAPT therapy was found to be associated with similar reperfusion rates, clinical outcomes, and complication rates compared to thrombectomy with SRs.[41] Overall, studies describing aspiration thrombectomy alone or in combination with IV-tPA reported high recanalization rates with good clinical outcomes.

1.6.3.3 Combination of stent retriever and direct aspiration

There are attempts to enhance the rate of successful recanalization through a combination of SR thrombectomy and direct clot aspiration. The first is called the "switching strategy," which involves switching from forced arterial suction thrombectomy (FAST) using the Penumbra reperfusion catheter to Solitaire™ stent thrombectomy, and this has been suggested to provide better angiographic outcomes than a one technique-only strategy. Another is called "SOLUMBRA" technique, which involves the combination of stent retrievers and large-bore aspiration catheters. The stent retriever is removed under concurrent aspiration to minimize clot fragmentation and potential distal vessel occlusion.[34]

1.6.4 Available Technologies

Intermediate/distal access catheters and aspiration catheters, such as those listed within the SOFIA Catheter Family, are well established medical devices with numerous types and styles available from a variety of manufacturers. A few examples of catheters similar to the SOFIA Catheter Family are listed in Table 3.1.

Table 3.1 Similar Marketed Approved Catheters

Device	Manufacturer	Intended Use
Penumbra® Reperfusion Catheter	Penumbra	Penumbra Reperfusion Catheters are intended for use in the revascularization of patients with acute ischemic stroke secondary to large vessel occlusion.
React™ 68 catheter	Medtronic	The React 68 Catheter is indicated for the introduction of interventional devices into the peripheral and neuro vasculature.

ZOOM 88	Imperative Care	The Zoom 88 Large Distal Platform is indicated for the introduction of interventional devices into the peripheral, coronary, and neuro vasculature.

1.7 Suggested Profile and Training for Users

This device should only be used by physicians who have undergone training in the use of the SOFIA and SOFIA EX Catheters according to the instructions for use.

1.8 Reference to any Harmonized Standards and CS

Standard/Guidance No.	Standard/Guidance Name
ISO 13485	Medical devices - Quality management systems - Requirements for regulatory purposes
ISO 14971	Medical devices - Application of risk management to medical devices
IEC 62366-1	Medical devices - Application of usability engineering to medical devices
ISO 14644-1	Cleanrooms and associated controlled environments - Part 1: Classification of air cleanliness
ISO 14644-2	Cleanrooms and associated controlled environments - Part 2: Monitoring to provide evidence of cleanroom performance related to air cleanliness by particle concentration
ISO 20417	Medical devices — Information to be supplied by the manufacturer
ISO 11607-1	Packaging for terminally sterilized medical devices - Part 1: Requirements for materials, sterile barrier systems and packaging systems
ISO 11607-2	Packaging for terminally sterilized medical devices - Part 2: Validation requirements for forming, sealing and assembly processes
ISO 15223-1	Medical devices - Symbols to be used with medical device labels, labelling and information to be supplied - Part 1: General requirements
ISO 11135	Sterilization of health care products - Ethylene oxide - Part 1: Requirements for development, validation and routine control of a sterilization process for medical devices
ASTM F1980	Standard guide for accelerated aging of sterile barrier systems for medical devices
ISTA 3A	ISTA (International Safe Transit Association) Procedure 3A – Performance Tests for Packaged-Products for Parcel Delivery System 150 lbs. (70 kg) or Less
ISO 10993-1	Biological evaluation of medical devices - Part 1: Evaluation and testing within a risk management process
ISO 10993-3	Biological evaluation of medical devices - Part 3: Tests for genotoxicity, carcinogenicity and reproductive toxicity
ISO 10993-4	Biological evaluation of medical devices - Part 4: Selection of tests for interactions with blood
ISO 10993-5	Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity
ISO 10993-7	Biological evaluation of medical devices - Part 7: Ethylene oxide sterilization residuals
ISO 10993-10	Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization

ISO 10993-11	Biological evaluation of medical devices - Part 11: Tests for systemic toxicity
ISO 10993-12	Biological evaluation of medical devices - Part 12: Sample preparation and reference materials
ISO 10555-1	Sterile, Single-Use Intravascular Catheters
ISO 80369-7	Small-bore connectors for liquids and gases in healthcare applications — Part 7: Connectors for intravascular or hypodermic applications
ISO 11070	Sterile single-use intravascular introducers, dilators and guidewires
MEDDEV 2.7/1	Clinical Evaluation: A Guide for Manufacturers and Notified Bodies
MDR	European Medical Device Regulation (MDR) 2017/745

1.9 References

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1.10 Revision History

SSCP Revision	Date Issued	Change Description	NB Validation
A	28 March 2022	Initial Document	☒Yes ☐ No* Validation language:
B	13 November 2023	Updating using content provided in CER21-0000D, addition of SOFIA 88 information	☒ Yes ☐ No* Validation language:

*only applicable for class IIa or some IIb implantable devices for which the SSCP is not yet validated by the NB

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