Jochen Wöhrle (University of Ulm, Ulm, Germany, Head Interventional Cardiology Research Group) observes that the figure of about 4.4% (based on a weighted average from published studies) only refers to clinically observable stroke, reassuring that even delirium, transient ischaemic attack and non-disabling stroke have consequences for increased mortality—it does not address the risk of silent ischaemia. He comments: “There is a discrepancy between symptomatic stroke identified through clinical examination and silent ischaemia seen via cerebral imaging. With MRI, the rate of silent ischaemia is much higher—it is actually above 80%.”

Therefore, he uses the Sentinel device (Claret Medical) to not only reduce the risk of clinically overt stroke but to also reduce the risk of silent ischaemia infarcts, which are associated with increased risk of future stroke, cognitive dysfunction, and dementia.

Data from the SENTINEL study found that use of Sentinel was safe and was associated with a 42% reduction in new lesion volume and a significant 63% reduction in clinical strokes at ≤72 hours.1,2 However, as it was a randomised controlled trial, it had a select patient cohort and, therefore, its findings are not necessarily applicable to all patients undergoing contemporary TAVI. To address how Sentinel performs with contemporary TAVI devices, Wöhrle and colleagues independently collected data from 522 prospective patients undergoing TAVI at their centre. They then reviewed outcomes of consecutive patients who had undergone TAVI with the Sentinel device (280) with those who underwent TAVI without the device (522) and performed a propensity matching.3 The primary composite endpoint was all-cause mortality or all stroke according to Valve Academic Research Consortium (VARC)-2 criteria within seven days. Secondary endpoints included technical success of the device.

In the propensity-matched analysis, seven-day all-cause mortality or all stroke occurred significantly less frequently in the group who were protected by the Sentinel device—2.1% vs. 6.8% for patients in whom Sentinel was not used (p = 0.01). Furthermore, use of the device was associated with a significant reduction in the rate of disabling and non-disabling stroke compared with not using the device: 1.4% vs. 4.6% (p = 0.03 for the comparison).4 On the basis of these findings, the authors conclude: “In patients undergoing protected TAVI, use of a Sentinel cerebral embolic protection device demonstrated a significantly higher rate of stroke-free survival compared with unprotected TAVI.”

In a subsequent patient-level pooled analysis conducted by Wöhrle and his colleagues, 1,263 patients from the original study were combined with patients from the SENTINEL study and showed “a significant reduction in the risk of stroke after TAVI with the Sentinel device that was independent of valve type”. He notes that he presented these data at TCT 2017.

Furthermore, Nicholas van Mieghem (Erasmus Medical Center, Rotterdam, The Netherlands) presented data at the 2018 Joint Interventional Meeting (22–24 February, Milan, Italy) that compared Sentinel use in 294 TAVI patients with 453 TAVI patients who did not receive Sentinel.5 Similar to the patient-level pooled analysis presented at TCT, these data showed an 80% reduction in stroke at 72-hours—from 5.1% for unprotected TAVI to 1% for protected TAVI (p = 0.01). To further compel the routine use of Sentinel, at the CRT 2018 congress Dr Raj Makkar from Cedars Sinai in Los Angeles showed his real-world TAVR stroke data in 419 patients since his routine use of Sentinel started in June 2017, which also showed a 78% reduction (6.3% in 128 unprotected patients vs. 1.4% in 291 Sentinel protected patients) in clinical stroke in the first seven days post TAVI.6

Aside from assessing the effectiveness of the Sentinel device, another aim of the study by Wöhrle and his colleagues was to identify which patients were at high risk of stroke. According to Wöhrle, at present, knowing which patients will have a stroke after TAVI is difficult. He says: “We have seen patients with a high degree of calcification, as might be expected, have a stroke. But, we have also seen patients without such extensive calcification— therefore, we did not suspect would have a stroke—have an event. To explore this issue further, in the patient level pooled analysis, Wöhrle performed a multivariate analysis of independent predictors of the risk of stroke after TAVI. Not using Sentinel was the only independent predictor of stroke at seven days. (STS score and non-use of Sentinel were the only independent predictors of the combined endpoint of all-cause mortality and all-stroke at seven-days).”

Given that lack of use of Sentinel was an independent predictor of stroke, as already mentioned, Wöhrle uses it in all patients. This not only provides reassurance to the operators but also provides reassurance to the patients. “Patients are concerned about complications and, in particular, they are concerned about the risk of stroke. Thus, they are happy when we tell them that we use a protection device. In fact, we have patients coming from (northern) areas such as Berlin and Hamburg—we are in the south of Germany—because they know that we use Sentinel when we perform TAVI.”

According to Wöhrle, the device is “easy to use” in most patients, but he estimates that about 10% of patients will have difficult anatomies that can make the positioning of the device more complicated. He does, however, note that using the device in tricky anatomies becomes easier with practice—commenting: “When you use the device in every patient, you build up a lot of experience. We have now done 800 procedures with the device and we now use it in patients in whom we would not have used it two or three years ago.”

References
4. BIBA Medical staff. Study of cerebral protection during TAVI only meets primary efficacy endpoint in adjusted model. Cardiovascular News 2017; 44:10
5. Van Mieghem N, JIM 2018
6. Makkar R, CRT 2018
SENTINEL Cerebral Protection System (CPS)

INDICATIONS FOR USE: The Sentinel Cerebral Protection System is indicated for use as an embolic protection device to capture and remove thrombus/debris while performing transcatheter aortic valve replacement procedures. The diameters of the arteries at the site of filter placement should be between 9 – 15 mm for the brachiocephalic and 6.5 – 10 mm in the left common carotid. CONTRAINDICATIONS • Do not use in patients for whom anticoagulant and antiplatelet therapy is contraindicated. • Do not use in patients with a known hypersensitivity to nickel-titanium. • Do not use in vessels with excessive tortuosity. • Do not use in patients with uncorrected bleeding disorders. • Do not use in patients with compromised blood flow to the right upper extremity. • Do not use in patients who have arterial stenosis >70% in either the left common carotid artery or the brachiocephalic artery. • Do not use in patients whose brachiocephalic or left carotid artery reveals significant stenosis, ectasia, dissection, or aneurysm at the aortic ostium or within 3 cm of the aortic ostium. WARNINGS • Carefully read all instructions and labeling prior to use. Observe all warnings, cautions, and precautions noted throughout these instructions. Failure to do so may result in complications. • Refer to the instructions for use supplied with any interventional devices to be used in conjunction with the Sentinel System for their intended uses, sizing, warnings, and precautions. • The safety and effectiveness of the Sentinel System have not been demonstrated with transcatheter aortic valves other than the SAPIEN XT, SAPIEN 3, CoreValve®, and CoreValve Evolut R®. • The appropriate antiplatelet/anticoagulation therapy should be administered pre- and post-procedure in accordance with standard medical practice. • Prior to use, the packaging and product should be inspected for signs of damage. Never use a damaged product or product from a damaged package. • Never advance or withdraw the Sentinel System without proper fluoroscopic guidance or against resistance until the cause is determined. Advancing with such resistance may lead to embolization of debris, and vessel and/or device damage. • It is recommended that the patency of the right radial or brachial artery be assessed prior to the introduction of the Sentinel System. • It is recommended that the patient be tested for occlusion of the radial or brachial artery prior to device introduction. • Do not use the device in left radial or left brachial access. • Do not use the Sentinel System to deliver any type of fluid to the patient e.g. contrast media, heparinized saline, etc. due to risk of air embolization and comprise to device performance. • Minimize movement of the Sentinel System after initial placement and stabilize the patient’s right arm by their side. Excessive movement of filters may lead to embolization of debris, vessel and/or device damage. • Do not deploy the filters within a previously repaired artery, an artery that has been used for dialysis purposes, or an AV fistula. • Observe the Sentinel System under fluoroscopy and monitor the patient to verify the filters have not become occluded or flow is compromised (See Procedural Use – Retrieval). • Indwell time of the Sentinel System is not to exceed 90 minutes as occlusion could occur, resulting in slow or no flow. • Failure to adequately close off the Flush Ports (Front Handle, Rear Handle) may result in air embolism. • Do not undersize or oversize the filters in relation to the selected vessel diameter. This may result in inadequate vessel wall apposition or incomplete deployment of the filters. (Refer to Sizing Guide, Table 1 in IFU). • Do not apply excessive force to the Sentinel System. This may lead to distal embolization of debris, and vessel and/or device damage. PRECAUTIONS • Do not forcefully bend or reshape the Articulating Sheath of the Sentinel System. This may cause device damage. • A guidewire with excessive stiffness may alter the shape of the Articulating Sheath curve and make cannulation of the left common carotid difficult. • Use of a guidewire with an intermediate coil may result in compromised guidewire movement. • Improper bending of the Sentinel System may damage the catheter. • Do not re-sterilize or reuse on another vessel or patient. ADVERSE EVENTS Possible adverse events associated with Sentinel System use and application procedure include, but are not limited to, the following: • Access site complications • Angina • Aortic dissection • Arrhythmia • Arteriovenous fistula • Atelectasis • Bleeding, operative or post-operative • Cardiac Tamponade • Cardiogenic Shock • Conduction system injury • Congestive Heart Failure (CHF) • Death • Endocarditis • Embolism, including air • Gastrointestinal (GI) bleed • Hematoma • Ischemia (coronary, limb, carotid) • Infection (local or systemic) • Myocardial Infarction (MI) • Nerve injury • Pericardial effusion • Pneumonia • Pulmonary edema • Pulmonary embolism • Respiratory failure • Respiratory insufficiency • Stroke • Vessel injury (e.g., dissection, rupture, perforation, pseudoaneurysm) Adverse events experienced during clinical studies are presented in the Clinical Study Overview section of the Instructions For Use (IFU). Rx Only, CAUTION: Federal Law (USA) restricts this device to sale by or on the order of a physician. SH-608919-AA