

# Mechanical clot retrieval for treating acute ischaemic stroke

Interventional procedures guidance  
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[www.nice.org.uk/guidance/ipg548](http://www.nice.org.uk/guidance/ipg548)

## Your responsibility

This guidance represents the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take this guidance fully into account, and specifically any special arrangements relating to the introduction of new interventional procedures. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the [Yellow Card Scheme](#).

Commissioners and/or providers have a responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with

those duties. Providers should ensure that governance structures are in place to review, authorise and monitor the introduction of new devices and procedures.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

This guidance replaces IPG458.

## 1 Recommendations

- 1.1 Current evidence on the safety and efficacy of mechanical clot retrieval for treating acute ischaemic stroke is adequate to support the use of this procedure provided that standard arrangements are in place for clinical governance, consent and audit.
- 1.2 Selection of patients for mechanical clot retrieval for treating acute ischaemic stroke should be done by clinicians experienced in the use of thrombolysis for stroke and in interpretation of relevant imaging. The procedure should only be carried out by appropriately trained specialists with regular experience in intracranial endovascular interventions, with appropriate facilities and neuroscience support.

## 2 Indications and current treatments

- 2.1 Acute ischaemic stroke is usually caused by arterial thrombosis or embolism. This results in loss of neurological function leading to symptoms such as numbness or weakness of the face, arm or leg on one side of the body, and often problems with speech and swallowing.
- 2.2 Patients suspected of having an acute ischaemic stroke should have rapid assessment and early intervention with specialist care according to NICE's guideline on stroke and transient ischaemic attack in over 16s: diagnosis and

initial management. Recanalisation strategies, such as thrombolysis, attempt to re-establish blood flow so that cells starved of oxygen can be rescued before they are irreversibly damaged. Effective stroke care also includes specialised supportive care and rehabilitation.

- 2.3 Mechanical clot retrieval for treating acute ischaemic stroke aims to remove the obstructing blood clot or other material from arteries within the brain, restoring blood flow to the brain and minimising brain tissue damage.

## 3 The procedure

- 3.1 Mechanical clot retrieval for treating acute ischaemic stroke is done for stroke caused by blockage of a main cerebral artery. Immediately after they are admitted to hospital, patients have a CT scan and a CT or MR angiogram to confirm the presence of a major vessel occlusion. The procedure is then usually done with the patient under sedation, but sometimes general anaesthesia is used. Conventional cerebral angiography is done to show the exact location of the arterial occlusion. A delivery catheter is inserted, usually through the femoral artery in the groin, and advanced into the occluded artery using X-ray guidance. A clot-retrieval device attached to a guidewire is introduced through the delivery catheter to the site of the occlusion, to remove the clot and re-establish blood flow to the affected part of the brain. Many patients will also have had initial treatment with intravenous thrombolysis.
- 3.2 Several types of device and different techniques have been used for clot retrieval. Most recent clinical trial evidence is based on the use of stent retrievers, which are currently the most commonly used type of device. The stent retriever is a self-expanding metal mesh tube that is introduced through a catheter and partially deployed within the clot. The stent retriever traps the clot within its mesh and is then withdrawn through the catheter.
- 3.3 The aim is to perform the procedure as soon as possible after the onset of stroke symptoms.

## 4 Efficacy

This section describes efficacy outcomes from the published literature that the committee considered as part of the evidence about this procedure. The efficacy outcomes described below include death occurring more than 30 days after the procedure. Deaths occurring within 30 days or as a result of intracranial haemorrhage are reported as safety outcomes. For more detailed information on the evidence, see the [interventional procedure overview](#).

- 4.1 A systematic review of 8 randomised controlled trials (RCTs), including 2,423 patients, reported that endovascular thrombectomy was associated with improved functional outcomes at 90 day follow-up (modified Rankin scale score 0 to 2, odds ratio 1.56, 95% confidence interval [CI] 1.32 to 1.85,  $p < 0.00001$ ).
- 4.2 An RCT, included in the systematic review, of 500 patients with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) and usual care, or usual care alone reported that the median modified Rankin scale score (7-point scale ranging from 0 [no symptoms] to 6 [death]) was significantly lower in the intervention group compared with the control group at 90 days (3 compared with 4, adjusted odds ratio 1.67, 95% CI 1.21 to 2.30). In the same study, 33% (76 of 233) of patients in the intervention group had a modified Rankin score of 0 to 2, indicating functional independence, compared with 19% (51 of 267) of patients in the control group (adjusted odds ratio 2.16, 95% CI 1.39 to 3.38).
- 4.3 An RCT, included in the systematic review, of 70 patients treated by mechanical clot retrieval with a retrievable stent or by thrombolysis alone reported that 80% (28 of 35) of patients treated by clot retrieval had an improvement of 8 points or more, or a score of 0 or 1 at day 3, on the National Institutes of Health Stroke Scale (NIHSS; scores range from 0 [normal] to 42 [death]) compared with 37% (13 of 35) of patients in the control group (adjusted odds ratio 6.0, 95% CI 2.0 to 18.0,  $p = 0.002$ ).
- 4.4 Two RCTs, included in the systematic review, of 315 and 206 patients treated by mechanical clot retrieval and standard care, or by standard care alone, reported that 53% (87 of 164) and 44% (absolute numbers not reported) of patients in the intervention group had a modified Rankin score of 0 to 2, respectively, compared

- with 29% (43 of 147) and 28%, respectively (absolute numbers not reported) of patients in the control group (rate ratio 1.7, 95% CI 1.3 to 2.2; odds ratio 2.1, 95% CI 1.1 to 4.0).
- 4.5 An RCT, included in the systematic review, of 196 patients treated by mechanical clot retrieval with a stent retriever and intravenous tissue plasminogen activator (tPA), or by intravenous tPA alone, reported that 60% (59 of 98) of patients in the intervention group had a modified Rankin score of 0 to 2 at 90 days, compared with 35% (33 of 93) of patients in the control group (risk ratio 1.70, 95% CI 1.23 to 2.33,  $p < 0.001$ ).
- 4.6 The RCT of 500 patients with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) and usual care, or by usual care alone, reported that 75% (141 of 187) and 33% (68 of 207) of patients, respectively, had no intracranial artery occlusion on follow-up CT angiography (odds ratio 6.88, 95% CI 4.34 to 10.94).
- 4.7 The RCT of 196 patients reported at least 90% reperfusion at 27 hours in 83% (53 of 64) of patients treated by mechanical clot retrieval with intravenous tPA compared against 40% (21 of 52) of patients treated by intravenous tPA alone (risk ratio 2.05, 95% CI 1.45 to 2.91,  $p < 0.001$ ). The RCT of 70 patients reported a median reperfusion of 100% at 24 hours for patients treated by mechanical clot retrieval with a retrievable stent compared against 37% for patients treated by thrombolysis alone (odds ratio 4.7, 95% CI 2.5 to 9.0,  $p < 0.001$ ).
- 4.8 The RCT of 206 patients treated by mechanical clot retrieval with a stent retriever and medical therapy, or by medical therapy alone, reported median infarct volumes at 24 hours of 16.3 ml and 38.6 ml, respectively ( $p = 0.02$ ). An RCT of 113 patients treated by mechanical clot retrieval with either a stent retriever or a coil retriever reported successful recanalisation without symptomatic intracranial haemorrhage in 61% (34 of 56) and 24% (13 of 54) of patients, respectively ( $p = 0.0001$ ).
- 4.9 The systematic review of 8 RCTs (2,423 patients) reported no significant difference in mortality at 90 days between the treatment groups (odds ratio 0.84, 95% CI 0.67 to 1.05,  $p = 0.12$ ). The RCTs of 196 and 206 patients reported death within 90 days for 9% (9 of 98) and 18% (19 of 103) of patients treated by

mechanical clot retrieval and medical therapy, respectively, compared against 12% (12 of 97) and 16% (16 of 103) of patients, respectively, treated by medical therapy alone (risk ratio 0.74, 95% CI 0.33 to 1.68,  $p=0.50$  and risk ratio 1.2, 95% CI 0.6 to 2.2).

- 4.10 The specialist advisers listed the following key efficacy outcomes: reduction in mortality, revascularisation as assessed by a validated scale, 90-day functional independence assessed by validated scales including the modified Rankin scale, quality of life, and timeline metrics of procedure.

## 5 Safety

This section describes safety outcomes from the published literature that the committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [interventional procedure overview](#).

- 5.1 Death within 7 days was reported in 12% (27 of 233) of patients with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) with usual care and in 12% (33 of 267) of patients treated by usual care alone in a randomised controlled trial (RCT) of 500 patients. Death within 30 days was reported in 19% (44 of 233) and 18% (49 of 267) of patients respectively, in the same study. Death within 7 days was reported in 10% (10 of 103) of patients treated by mechanical clot retrieval with medical therapy and in 5% (5 of 103) of patients treated by medical therapy alone in a RCT of 206 patients (risk ratio 2.0, 95% confidence interval [CI] 0.7 to 5.6). Death within 1 week was reported in 6% (6 of 106) of patients in a case series of 106 patients.
- 5.2 A systematic review of 8 RCTs (2,423 patients) reported no significant difference in the rate of symptomatic intracerebral haemorrhage between the treatment groups (odds ratio 1.03, 95% CI 0.71 to 1.49,  $p=0.88$ ). Symptomatic intracerebral haemorrhage was reported in 8% (18 of 233) of patients with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) with usual care and in 6% (17 of 267) of patients treated by usual care alone in the RCT of 500 patients in the systematic review. Hemicraniectomy was done in 6% (14 of 233) and 5% (13 of 267) of patients

respectively.

- 5.3 Symptomatic intracerebral haemorrhage was reported in 4% (6 of 165) of patients treated by mechanical clot retrieval with standard care and in 3% (4 of 150) of patients treated by standard care alone in an RCT of 315 patients in the systematic review (rate ratio 1.2, 95% CI 0.3 to 4.6); 1 patient in the intervention group was treated by hemicraniectomy.
- 5.4 Symptomatic intracranial haemorrhage at 27 hours was reported in no patients treated by intravenous tissue plasminogen activator (tPA) with mechanical clot retrieval and in 3% (3 of 97) of patients treated by intravenous tPA alone ( $p=0.12$ ) in a RCT of 196 patients in the systematic review. Subarachnoid haemorrhage was reported in 4% (4 of 98) and 1% (1 of 97) of patients respectively ( $p=0.37$ ) and parenchymal haematoma in 5% (5 of 98) and 7% (7 of 97) of patients respectively, in the same study.
- 5.5 Symptomatic intracranial haemorrhage diagnosed using the SITS-MOST criteria was reported in 2% (2 of 103) of patients both in the mechanical clot retrieval with medical therapy group and in the patients treated by medical therapy alone in the RCT of 206 patients in the systematic review. Subarachnoid haemorrhage was reported in 5% (5 of 103) and 2% (2 of 103) of patients, respectively, and parenchymal haematoma was reported in 6% (6 of 103) of patients in both groups, in the same study.
- 5.6 Symptomatic intracranial haemorrhage was reported in 1% (1 of 89) of patients treated by mechanical clot retrieval using a stent retriever and in 11% (6 of 55) of patients treated by mechanical clot retrieval using a coil retriever in a RCT of 113 patients ( $p=0.013$ ). In the same study, symptomatic subarachnoid haemorrhage was reported in 1% (1 of 89) and 7% (4 of 55) of patients respectively ( $p=0.07$ ).
- 5.7 New ischaemic stroke in a different vascular territory was reported in 6% (13 of 233) of patients with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) with usual care and in less than 1% (1 of 267) of patients treated by usual care alone in the RCT of 500 patients ( $p<0.001$ ).

- 5.8 Large or malignant middle cerebral artery stroke was reported in 5% (8 of 165) of patients treated by mechanical clot retrieval with standard care and in 11% (16 of 150) of patients treated by standard care alone in the RCT of 315 patients (rate ratio 0.3, 95% CI 0.1 to 0.7); 1 patient in the control group was treated by hemicraniectomy.
- 5.9 Symptomatic ischaemic stroke was reported in 3% (3 of 89) of patients treated by mechanical clot retrieval using a stent retriever and in 13% (7 of 55) of patients treated by mechanical clot retrieval using a coil retriever in the RCT of 113 patients (p=0.04).
- 5.10 Embolisation into new vascular territories was reported in 9% (20 of 233) of patients with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) with usual care in the RCT of 500 patients.
- 5.11 Asymptomatic embolisation into a different vascular territory occurred in 6% (2 of 35) of patients treated by mechanical clot retrieval in an RCT of 70 patients. Distal embolisation in a different territory was reported in 5% (5 of 103) of patients treated by mechanical clot retrieval with medical therapy in the RCT of 206 patients.
- 5.12 Vessel dissection and vessel perforation were reported in 2% (4 of 233) and 1% (2 of 233) of patients, respectively, with acute ischaemic stroke treated by intra-arterial treatment (intra-arterial thrombolysis, mechanical clot retrieval, or both) with usual care in the RCT of 500 patients. Perforation of the middle cerebral artery was reported in 1 patient treated by mechanical clot retrieval in the RCT of 315 patients.
- 5.13 Arterial dissection and arterial perforation were reported in 4% (4 of 103) and 5% (5 of 103) of patients treated by mechanical clot retrieval in the RCT of 206 patients.
- 5.14 Dissection of the access vessel was reported in 4% (4 of 106) of patients in a case series of 106 patients and dissection of the target vessel was reported in 5% (5 of 106): all 5 patients also had subarachnoid haemorrhage.



- 5.15 Vessel dissection was reported in 4% (4 of 89) of patients treated by mechanical clot retrieval using a stent retriever and in 1 patient treated by mechanical clot retrieval using a coil retriever in the RCT of 113 patients ( $p=0.65$ ): 3 patients were managed conservatively, 1 patient was treated by balloon angioplasty and 1 patient was treated by stent placement.
- 5.16 Malignant cerebral oedema was reported in 11% (11 of 103) of patients with acute ischaemic stroke treated by mechanical clot retrieval with medical therapy and in 10% (10 of 103) of patients treated by medical therapy alone in the RCT of 206 patients (risk ratio 1.1, 95% CI 0.5 to 2.5): 3 patients in the intervention group and 6 patients in the control group were treated by decompressive hemicraniectomy.
- 5.17 Unintended stent detachment was reported in 3% (3 of 106) of patients in the case series of 106 patients. Technical difficulty with the device was reported in 10% (9 of 89) of patients treated by mechanical clot retrieval using a stent retriever and in 7% (4 of 55) of patients treated by mechanical clot retrieval using a coil retriever in the RCT of 113 patients ( $p=0.77$ ). A trapped cerebral thrombectomy device was reported in a case report: the patient was treated by carotid endarterectomy to remove a carotid stent with the trapped clot retrieval device inside. The patient showed no clinical deterioration and was discharged from hospital 6 days later.
- 5.18 In addition to safety outcomes reported in the literature, specialist advisers are asked about anecdotal adverse events (events which they have heard about) and about theoretical adverse events (events which they think might possibly occur, even if they have never done so). For this procedure, specialist advisers listed the following anecdotal adverse events: vasospasm, distal embolisation beyond site of initial thrombus, worsened stroke, groin haemorrhage and retroperitoneal haemorrhage. They considered that the following were theoretical adverse events: device malfunction (degeneration of internal structure), reperfusion injury and contrast allergy.

## 6 Committee comments

- 6.1 The committee noted that the technology used in mechanical clot retrieval

fortreating acute ischaemic stroke is evolving and that outcomes may vary between different types of retrieval device. Most of the evidence considered by the committee was based on the use of stent retrievers.

- 6.2 The committee was advised that the clinical outcomes of this procedure are better the sooner after the onset of stroke symptoms it is done. It noted that the published evidence was largely related to patients receiving treatment within 8 hours.
- 6.3 The committee was advised that there are uncertainties about a number of factors in relation to the procedure, which could guide future evidence development, including:
- the precise relationship between the interval from the onset of symptoms to treatment and clinical outcomes
  - the best type of imaging to guide patient selection
  - the best kind of retrieval device
  - whether to use clot retrieval plus thrombolysis or clot retrieval alone
  - the effectiveness of the procedure in patients with strokes in different parts of the brain (specifically anterior and posterior circulation areas).
- 6.4 The committee noted the large number of comments received from patients about this procedure, many of which were positive.

## 7 Further information

### Information for patients

NICE has produced [information on this procedure for patients and carers](#). It explains the nature of the procedure and the guidance issued by NICE, and has been written with patient consent in mind.

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# Endorsing organisation

This guidance has been endorsed by [Healthcare Improvement Scotland](#).