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[Intervention Review]

Carotid artery stenting versus endarterectomy for treatment of carotid artery stenosis

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ABSTRACT

Background

Carotid artery stenting is an alternative to carotid endarterectomy for the treatment of atherosclerotic carotid artery stenosis. This review updates a previous version first published in 1997 and subsequently updated in 2004, 2007, and 2012.

Objectives

To assess the benefits and risks of stenting compared with endarterectomy in people with symptomatic or asymptomatic carotid stenosis.

Search methods

We searched the Cochrane Stroke Group Trials Register (last searched August 2018) and the following databases: CENTRAL, MEDLINE, Embase, and Science Citation Index to August 2018. We also searched ongoing trials registers (August 2018) and reference lists, and contacted researchers in the field.

Selection criteria

Randomised controlled trials (RCTs) comparing stenting with endarterectomy for symptomatic or asymptomatic atherosclerotic carotid stenosis. In addition, we included RCTs comparing carotid artery stenting with medical therapy alone.

Data collection and analysis

One review author selected trials for inclusion, assessed trial quality and risk of bias, and extracted data. A second review author independently validated trial selection and a third review author independently validated data extraction. We calculated treatment effects as odds ratios (OR) and 95% confidence intervals (CI), with endarterectomy as the reference group. We quantified heterogeneity using the I^2 statistic and used GRADE to assess the overall certainty of evidence.

Main results

We included 22 trials involving 9753 participants. In participants with symptomatic carotid stenosis, compared with endarterectomy stenting was associated with a higher risk of periprocedural death or stroke (the primary safety outcome; OR 1.70, 95% CI 1.31 to 2.19; P < 0.0001, I^2 = 5%; 10 trials, 5396 participants; high-certainty evidence); and periprocedural death, stroke, or myocardial infarction (OR 1.43, 95% CI 1.14 to 1.80; P = 0.002, I^2 = 0%; 6 trials, 4861 participants; high-certainty evidence). The OR for the primary safety outcome was 1.11 (95% CI 0.74 to 1.64) in participants under 70 years old and 2.23 (95% CI 1.61 to 3.08) in participants 70 years old or more (interaction P = 0.007). There was a non-significant increase in periprocedural death or major or disabling stroke with stenting (OR 1.36, 95% CI 0.97 to 1.91; P = 0.08, I^2 = 0%; 7 trials, 4983 participants; high-certainty evidence). Compared with endarterectomy, stenting was associated with

lower risks of myocardial infarction (OR 0.47, 95% CI 0.24 to 0.94; P = 0.03, I^2 = 0%), cranial nerve palsy (OR 0.09, 95% CI 0.06 to 0.16; P < 0.00001, I^2 = 0%), and access site haematoma (OR 0.32, 95% CI 0.15 to 0.68; P = 0.003, I^2 = 27%).

The combination of periprocedural death or stroke or ipsilateral stroke during follow-up (the primary combined safety and efficacy outcome) favoured endarterectomy (OR 1.51, 95% CI 1.24 to 1.85; P < 0.0001, I^2 = 0%; 8 trials, 5080 participants; high-certainty evidence). The rate of ipsilateral stroke after the periprocedural period did not differ between treatments (OR 1.05, 95% CI 0.75 to 1.47; P = 0.77, I^2 = 0%).

In participants with asymptomatic carotid stenosis, there was a non-significant increase in periprocedural death or stroke with stenting compared with endarterectomy (OR 1.72, 95% CI 1.00 to 2.97; P = 0.05, I^2 = 0%; 7 trials, 3378 participants; moderate-certainty evidence). The risk of periprocedural death or stroke or ipsilateral stroke during follow-up did not differ significantly between treatments (OR 1.27, 95% CI 0.87 to 1.84; P = 0.22, I^2 = 0%; 6 trials, 3315 participants; moderate-certainty evidence).

Moderate or higher carotid artery restenosis (50% or greater) or occlusion during follow-up was more common after stenting (OR 2.00, 95% CI 1.12 to 3.60; P = 0.02, I^2 = 44%), but the difference in risk of severe restenosis was not significant (70% or greater; OR 1.26, 95% CI 0.79 to 2.00; P = 0.33, I^2 = 58%; low-certainty evidence).

Authors' conclusions

Stenting for symptomatic carotid stenosis is associated with a higher risk of periprocedural stroke or death than endarterectomy. This extra risk is mostly attributed to an increase in minor, non-disabling strokes occurring in people older than 70 years. Beyond the periprocedural period, carotid stenting is as effective in preventing recurrent stroke as endarterectomy. However, combining procedural safety and long-term efficacy in preventing recurrent stroke still favours endarterectomy.

In people with asymptomatic carotid stenosis, there may be a small increase in the risk of periprocedural stroke or death with stenting compared with endarterectomy. However, CIs of treatment effects were wide and further data from randomised trials in people with asymptomatic stenosis are needed.

PLAIN LANGUAGE SUMMARY

Metal tubes (stents) or surgery (endarterectomy) for treatment of carotid stenosis

Review question

In people with narrowing of the carotid arteries, what are the risks and benefits of inserting metal tubes (stents) compared to surgical removal of the narrowing?

Background

Carotid stenosis, a narrowing of a major blood vessel in the neck carrying blood to the brain, can cause stroke. The standard treatment is to remove the narrowing by surgery, in which the surgeon opens the artery and removes the plaque (carotid endarterectomy). An alternative treatment (carotid artery stenting) uses a fine catheter tube which is passed through the skin and into the narrowed blood vessel. A metal tube (stent) is placed inside the vessel to prevent it narrowing again.

Study characteristics

We examined evidence about benefits and risks from studies that compared carotid artery stenting to carotid surgery in people who already had symptoms caused by carotid stenosis (stroke, transient ischaemic attack (TIA), or ocular (eye) symptoms) or in people who have never experienced symptoms. The studies had to be randomised; that is, the decision whether people were treated by stenting or surgery had to be made randomly and neither they nor the researchers were able to decide which treatment they received. This was to make the comparison as unbiased, or fair, as possible. We searched for studies up to August 2018. We assessed the quality of all the studies we included.

Key results and conclusions

This review included 22 studies involving 9753 participants.

In people who have already experienced symptoms from a narrowing in the carotid artery, stenting caused more strokes or deaths around the time of the procedure than surgery. This was especially true for people over the age of 70 years. After the initial procedure, both treatments were equally effective in preventing stroke or death in the long term.

In people who had never experienced symptoms from the carotid stenosis, both carotid artery stenting and surgery carried a similar risk of stroke or death in the short and long term, although the certainty of the evidence in these people was only moderate and the results should be interpreted with caution.

Quality of the evidence

In general, the quality of the evidence was high. The main factor reducing our confidence in the evidence was in studies comparing both treatments in people who had never experienced symptoms from the narrowing in the carotid artery. For these people, more studies are needed to draw firm conclusions about the risks and benefits of stenting compared to surgery.