

Letters to the Editor

Transcranial Doppler detected cerebral microembolism following carotid endarterectomy

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Abbreviation: TCD = transcranial Doppler (detection)

We were interested to read the prospective study by Levi *et al.* (1991) describing the transcranial Doppler (TCD) detection of emboli in the early postoperative phase of carotid endarterectomy. Their finding that embolization was significantly associated with the development of postoperative strokes strongly supports the findings in our own prospective study of perioperative embolization which the authors kindly referred to in their article (Gaunt *et al.*, 1994). The results from their well-conducted study provide further confirmation of the importance of the early postoperative phase in the occurrence of perioperative strokes. However, it should not be ignored that TCD can detect and help prevent strokes occurring during all the phases of the operation, especially embolization of unstable plaque during the initial dissection of the carotid artery and haemodynamic stroke resulting from either inadequate cerebral blood supply at the time of clamping or shunt malfunction (Gaunt *et al.*, 1994).

There are two essential features of an effective monitoring method: (i) it can detect the majority of abnormalities; and (ii) abnormalities are detected soon enough to enable corrective action to prevent permanent neurological damage (Gaunt *et al.*, 1997).

TCD detects embolization in the postoperative phase before the development of neurological deficits, and in our original study we advocated immediate reoperation to remove the thrombus from the carotid artery and prevent further embolization (Gaunt *et al.*, 1994). However, the possibility that this may represent an overtreatment in some cases, and occasional practical difficulties in returning a patient to theatre, prompted us to investigate the alternative therapy of dextran 40 infusion.

Our centre recently completed a prospective study of 100 consecutive patients undergoing carotid endarterectomy investigating the use of dextran 40 to arrest postoperative embolization detected by TCD monitoring. Overall, 48% of patients experienced emboli in the 6-h postoperative monitoring period; however, only 8% had >50 and 5% >100 emboli. An incremental dextran infusion was instituted in all patients with >25 emboli detected in any 10-min period of monitoring and this resulted in cessation of embolization in

all patients in which it was used (Lennard *et al.*, 1997). The results from this study appear very promising and no patient in this series experienced any neurological deficit (Lennard *et al.*, 1997). However, further experience suggests that, in the presence of an uncorrected technical error, dextran may be unable to arrest thrombus formation, and reoperation is then indicated based on the TCD evidence of continued embolization possibly combined with a falling middle cerebral artery velocity. This only serves to emphasize the importance of TCD monitoring in the postoperative phase and the potential risks of blind dextran administration.

In conclusion, a low perioperative stroke rate is important for all clinicians associated with carotid endarterectomy. Equally important is the need to minimize the number of preventable strokes and these can only be prevented if the underlying mechanisms are understood. Experience with TCD monitoring has modified our understanding of how many perioperative strokes occur and enabled the development of both intraoperative and postoperative intervention strategies. Further evaluation of these strategies is necessary but experience with TCD monitoring has established that the key to preventing the majority of perioperative strokes is the detection of embolization (Gaunt *et al.*, 1997). TCD is the only monitoring method which supplies this information and the study by Levi *et al.* (1997) is an important contribution to the subject.

References

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Reply

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We thank Gaunt and his colleagues for their comments. Our series of patients undergoing carotid endarterectomy with TCD monitoring is currently being expanded to quantify the stroke risk associated with microembolism and to assess potential confounding factors such as patient age and technical imperfections on operative angiography. We certainly agree, however, that the identification of microembolism should prompt vigilance for early clinical signs of cerebral ischaemia and prompt urgent consideration of interventions such as surgical re-exploration of the endarterectomy site or antithrombotic therapy. Although the best treatment, once frequent microembolism is identified, is currently uncertain, the results reported by Lennard *et al.* (1997) are of great interest and suggest that the antithrombotic effects of low molecular weight dextran can arrest microembolism. We had considered an alternative option of preventing microembolism and are currently recruiting into a randomized controlled trial, to assess the efficacy of 10% dextran 40 in the prevention of both microembolism and clinical end-points during and following carotid endarterectomy.

In a number of cases we also have found intraoperative TCD monitoring for embolism to be of value in guiding the surgeon during arterial dissection, particularly in the presence

of intraluminal thrombus and/or degenerate atherosclerotic plaque. We were not, however, able to demonstrate any association between intraoperative brain microembolism and cerebral ischaemia (Levi *et al.*, 1997). This probably relates to the generally lower rates of particulate emboli generated during surgery (Levi *et al.*, 1997) and the capability of the microcirculation to deal with lower microembolic loads.

We agree that TCD monitoring provides a unique insight into the pathophysiology of an uncommon but important cause of stroke. It seems likely that this technique will prove to be an important tool in the prevention of stroke which can, unfortunately, complicate a procedure we commonly recommend for our patients.

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