

Preoperative Digital Carotid Compression as a Predictor of the Need for Shunting During Carotid Endarterectomy

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Abstract: This study prospectively attempted to assess the need for shunting by preoperative digital compression of the proximal common carotid artery and correlated these findings with intraoperative assessment while performing carotid endarterectomy under local anaesthesia. Preoperative digital compression is highly predictive of the need for shunting intra-operatively and can be used as a valuable test in carefully chosen patients. This may help in decreasing the need for advanced neurological monitoring during carotid endarterectomy.

Keywords: Carotid endarterectomy, Carotid shunting, Carotid monitoring.

INTRODUCTION

There is universal agreement that operating without a shunt during carotid endarterectomy (CEA) is technically easier and generally, quicker. Moreover, routine shunt utilization also has complications of its own. Several monitoring methods have been described to define which patients need shunting such as electro-encephalographic (EEG) monitoring, internal carotid artery back pressure, somatosensory evoked potentials (SSEP) and neurologic assessment while operating under local anesthesia [1-4]. We had noted in a previous study that common carotid clamping under local anesthetic accurately predicted the need for non-shunting on conversion to general anesthesia [5]. Thus, we prospectively attempted to assess the need for shunting by preoperative digital compression of the proximal common carotid artery and correlated these findings with intraoperative assessment while performing CEA under local anaesthesia.

METHODS

Fifty one consecutive patients having CEA for transient ischemic attacks (TIA) over a 5-year period were assessed after approval from the Medical Associates Hospital, where all patients were seen. Patients with stroke or any established neurologic deficit were excluded. The surgeon gave a detailed explanation of the test to the patient and relative in the presence of the nurse. They were told that digital carotid compression could possibly assist us in determining preoperatively if a shunt was necessary and that we were looking for altered consciousness or contralateral weakness on carotid compression. The plan was that we would correlate these findings with the need for shunting intra-operatively, while performing the procedure under local anesthetic.

Patient consent was routinely obtained. The patient was placed seated in a chair with a nurse and the relative standing about 2 meters in front of him/her. The surgeon stood behind the patient and palpated the relevant common carotid in the proximal neck (1-2 finger breaths superior to the sternoclavicular joint) with the tips of the index, middle and ring fingers. The patient was told that he or she would feel firm pressure as the neck is squeezed on that side.

The carotid artery was then compressed against the vertebral column by exerting digital pressure and the patient observed for 30 seconds. During this time patient was asked to lift the hand, move the leg and level of consciousness/awareness noted by the nurse, the relative and the surgeon giving the instructions. If any change occurred the procedure was stopped immediately, but if the patient remained normal it was continued for 30 seconds. After noting these findings, the patients were subjected to carotid endarterectomy, within one week, under local anesthesia and the need for shunting recorded.

RESULTS

Fifty one patients were included in the study. All 51 patients had transient ischemic attacks (TIA's) and a stenosis of 75-95%, on duplex scan (mean of 83%). Thirty (62.5%) had contralateral stenosis; in only 2 of these it was >60%. All patients were symptomatic and surgery was only done on the relevant side.

Of the 51 patients, 3 were excluded since the surgeon felt unsure about successful carotid compression because of a short, fat neck. Of the 48 remaining patients, 29 were male & 19 were female patients, the age ranged from 54 to 85 years with a mean age of 68 years. Twelve (25%) were known hypertensive patients, 14 (29%) were diabetics and 18 (37%) had ischaemic heart disease.

Forty five patients showed no changes during the carotid compression. Two cases showed both weakness of the con-

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tralateral side and altered consciousness within 10 seconds of compression. A third patient developed profound altered consciousness with no discernable lateralizing signs. In all 3 cases, these findings were completely reversed within 5 seconds of release of digital compression.

Table 1 shows the predictive ability of the test undertaken, the sensitivity was 100% and the specificity was 98%.

At surgery, conducted under regional anesthesia as we previously described (5), all 45 patients who showed no symptoms on digital compression did not need shunting at surgery and tolerated carotid clamping well. Both patients who had altered consciousness and contralateral weakness needed shunting. The patient who became very drowsy with no discernable weakness did not need shunting. One patient who initially tolerated clamping developed weakness after 7 minutes of clamping; this reversed completely on expeditious endarterectomy and clamp release 7 minutes later. Clamp time ranged from 12-30 minutes with a mean of 19 minutes.

DISCUSSION

Since carotid surgery without shunting should be both technically easier and quicker than if a shunt is used it would be useful if we could predict preoperatively, which patients are likely to need a shunt.

Thus far, the techniques of EEG, stump pressure, SSEP and neurologic monitoring in the awake patient are all intra-operative assessments of the need for shunting. In a previous series, if we had to convert the patient to general anaesthesia during carotid endarterectomy, we would first test clamp the common carotid in the awake patient. If clamping was tolerated after 3 minutes of clamping with no neurologic deficit, we would proceed to general anesthesia and surgery without shunting with good results [5]. Based on this observation we thought that we might be able to predict the need for shunting by preoperative digital compression of the common carotid. We felt that compression, well proximal to the bifurcation would be quite distant from the plaque and not risk embolisation or dissection. However, we were aware that possible errors could arise from (a) uncertainty of complete occlusion (as happened in the 3 excluded cases) (b) back flow perfusion from the external carotid to the internal (c) occlusion of the internal jugular vein and (d) possible asystole from pressure on the vagus nerve, especially in persons with hypersensitive carotid sinus [6]. In spite of these possible confounding factors, digital compression accurately predicted all 45 cases which needed no shunting. Of the 3 cases

that may have needed shunting one actually tolerated cross clamping and CEA with no need for a shunt. It may be that jugular vein or vagal compression could have contributed to his symptoms on digital pressure and these were not relevant at surgery where only the arterial system was occluded.

The greater the degree of stenosis, the smaller would be the net diminution in cerebral perfusion on clamping this very stenotic vessel. In our series, all patients had TIA's and mean stenosis of 83%. Thus, clamping would produce only a small diminution in flow if the systemic blood pressure is maintained. However, relative intraoperative hypotension can precipitate neurologic deficit and the need for shunting during cross-clamping [7]. There is evidence suggesting that more hemodynamic instability occurs under general anesthesia; thus, loco regional anesthesia could reduce the need for shunting due to hypotension [8].

In general, the need for shunting during CEA performed under loco-regional anesthesia ranges from 2-10% [4, 5, 7, 9]. Thus, it would appear unnecessary to do the procedure under GA with routine shunting or with special monitoring such as EEG, SSEP or stump pressure. In fact, there is some doubt the absolute reliability of these as predictors of need for shunting [9]. Moreover, it is clear that these monitoring techniques involve significant cost [10]. Also, anatomical abnormalities in the circle of Willis could influence the need for shunting [11]. However, since digital compression is carried out in the fully awake patient preoperatively, it is not necessary to study the anatomy of the intracranial vasculature to assess the need for shunting. Thus, time consuming and expensive arteriography can be avoided in the large majority of patients who have a negative digital compression test and may be considered in the few patients with a positive test to look for anatomical abnormalities or tandem lesions [12].

Of course, there are large numbers of CEA's done under GA with no shunting at all, and with acceptable complication rates [13-15]. However, most surgeons do not engage in this practice and prefer to either shunt routinely or selectively.

Our observation that it might be possible to identify, pre-operatively, those patients who do not need shunting could be useful in planning surgery; this could be particularly relevant in situations like ours where resources and monitoring facilities are quite limited. This possibility needs to be further tested in a high volume centre with a large number of patients, where CEA is performed under LA.

Table 1. Predictive Ability of the Digital Compression Test

Variable	Preoperatively Predicted to Need Shunt	Preoperatively Predicted that Shunt is Not needed	Total
Shunt needed intraoperatively	2	0	2
Did not need shunt intraoperatively	1	45	46
Total	3	45	48

Sensitivity: = 100%
 Specificity: = 97.8%
 Positive Predictive Value = 66.7%
 Negative Predictive Value = 100%

DECLARATION

The authors declare no financial or commercial interest in this work.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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Declared none.

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