A truncated ultrasound screening procedure for atheroma of the cervical arteries in asymptomatic diabetic patients: Evidence from a retrospective study

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Abstract

Aim. – To demonstrate that ultrasound screening of diabetic patients presenting with no cerebrovascular symptoms for evaluation of atheroma of the cervical arteries can be limited to the carotid arteries.

Methods. – We retrospectively analyzed the results of cervical artery ultrasound imaging of diabetic patients with no cerebrovascular symptoms. This diabetic population was divided into two subpopulations according to whether or not the vertebral and subclavian artery findings were normal or abnormal.

Results. – Of the 760 patients who fulfilled the criteria for study inclusion, the ultrasound imaging findings of the vertebral and subclavian arteries were normal in 712 cases. Review of the files of the 48 remaining patients showed that findings for either the vertebral or subclavian arteries did not lead to any changes in patient management because of associated risk factors, carotid atheroma or peripheral arterial disease.

Conclusion. – A vascular risk evaluation in diabetic patients could include ultrasound imaging assessment for cervical artery atheroma and our data suggest that such an evaluation could be focused solely on the carotid arteries.

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Résumé

Proposition d’un dépistage rapide de l’athérome des troncs supra-aortiques chez les patients diabétiques asymptomatiques: arguments d’une étude rétrospective.

Objectif. – Démontrer que l’écho-doppler réalisé chez les patients diabétiques asymptomatiques à titre de dépistage de l’athérome des troncs supra-aortiques peut se limiter à l’exploration des carotides.

Méthodes. – Nous avons analysé rétrospectivement les résultats d’écho-doppler des troncs supra-aortiques de diabétiques indemnes de symptômes cérébrovasculaires. Nous avons réparti cette population en deux sous-populations, l’une avec des axes vertébro-subclaviers normaux à l’écho-doppler, l’autre avec des résultats anormaux pour ces mêmes axes.

Résultats. – Parmi les 760 patients qui répondaient aux critères d’inclusion, les résultats de l’écho-doppler des axes vertébro-subclaviers étaient normaux chez 48 patients. L’examen de leurs dossiers a montré que la constatation d’anomalies des axes vertébro-subclaviers n’avait pas modifié la prise en charge de ces patients, du fait de l’existence concomitante de facteurs de risques, d’un athérome carotidien ou d’une artériopathie des membres inférieurs.

Conclusion. – L’évaluation du risque vasculaire de patients diabétiques peut inclure une évaluation de l’artériopathie des troncs supra-aortiques par examen écho-doppler. Notre étude suggère qu’elle peut se limiter à l’étude de ces axes.

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Cervical artery ultrasound imaging is useful for making the diagnosis and prognosis in several kinds of vascular diseases. This non-invasive examination is indicated where there are symptoms suggestive of a neurovascular disorder. Cervical artery ultrasound imaging is also performed on patients with no symptoms, but who have a high risk of carotid atheroma [1], including diabetic patients [2]. Exploring all of the extracranial cerebral arteries is necessary in patients who present with neurological symptoms, as such signs do not necessarily indicate a particular vascular territory. In the case of asymptomatic diabetic patients, the number of cervical doppler explorations has recently increased dramatically in the attempt to evaluate vascular disease. However, the question remains as to whether or not exploration of all of the extracranial cerebral arteries in patients with no symptoms is of any clinical benefit. In cases of severe asymptomatic carotid stenosis (up to 60%), surgery has been demonstrated to reduce the risk of stroke, leading to well-defined guidelines when ultrasonography reveals such a stenosis [1]. However, this is not the case for asymptomatic patients with pathological ultrasound findings in the vertebral or subclavian arteries [3]. The benefit of surgery on these arteries is not established in such patients. This raises the question of whether or not ultrasound exploration of the vertebral and subclavian arteries are of value in asymptomatic patients.

The objective of our study was to retrospectively ascertain whether or not ultrasonography that is focused only on the carotid arteries can identify any pathological findings in the vertebral and subclavian arteries that might change the preventative vascular procedure recommended for asymptomatic diabetic patients.

1. Patients and methods

We retrospectively analyzed the results of cervical artery ultrasound imaging performed between January 2000 and December 2004 as recorded in our hospital’s database. This database includes cardiovascular risk factors and cervical artery ultrasound findings, including the number of stenoses, if any. Every patient had undergone the same cervical artery ultrasound imaging protocol (Fig. 1), which was the standard procedure in our Department of vascular investigations derived from those suggested in handbooks of vascular ultrasound imaging [4]. The procedure allowed for quantification of an internal carotid stenosis based on its planimetry (when feasible) and its haemodynamic characteristics. The degree (percentage) of stenosis of the internal carotid artery, as determined by cervical ultrasound imaging, was converted (if necessary) to be compatible with the NASCET quantification system (see Myers and Clough [4] for a conversion table), and the results are reported here.

We selected the cervical artery ultrasound imaging results for the first risk evaluation in patients with diabetes (any type), but no cerebrovascular symptoms. Patients with neurological symptoms, or a history of stroke or transient ischaemic attacks, were not included. The study of diabetic population was divided into two subpopulations, according to whether or not the vertebral and subclavian artery findings were normal or abnormal. The abnormal subpopulation was further divided into three groups:

- group 1 had hypoplasia of at least one of the vertebral arteries;
- group 2 had occlusion of at least one of the vertebral or subclavian arteries;
- group 3 had abnormal flow other than no-flow (group 2) in at least one of the vertebral or subclavian arteries.

2. Results

On searching through the hospital database, 766 patients were found to match our inclusion criteria (first risk evaluation in diabetic patients with no cerebrovascular symptoms). However, six patients were excluded because a review of their files revealed a history of transient ischaemic attacks, stroke or surgery of the extracranial cerebral arteries.

3. Population characteristics

Of the 760 patients in the studied population, 66% were men. The study participants had a mean ± S.D. age of 65.1 ± 10.4 years (men: 64.3 ± 10.5 years; women: 66.7 ± 10.1 years). We voluntarily restricted cardiovascular risk factors other than diabetes to tobacco-smoking, hypertension (or taking medication for hypertension), dyslipidaemia (or taking medication for dyslipidaemia) and obesity, defined as a body mass index greater than 30. The number of patients displaying each factor is shown in Fig. 2. Of the studied population, 22% were smokers, 72% were hypertensive, 41% had dyslipidaemia and 32% were obese. Fig. 3 shows the distribution of these cumulative risk factors per patient: 34% of the study population had at least two other risk factors in addition to diabetes; 24%
had only one risk factor and 18% had no associated risk factors.

4. Population splitting

The 760 patients were split into two subpopulations of 712 and 48 patients with normal and abnormal findings, respectively, on vertebral and subclavian arteries. The subpopulation (N = 48) with abnormal vertebral or subclavian artery findings was further split into three groups:

- group 1 (hypoplasia): 10 patients;
- group 2 (occlusion): seven patients;
- group 3 (abnormal flow): 31 patients.

Subclavian steel syndrome was diagnosed in one of these patients, who also had anisotension. Two patients out of the remaining 30 had no atheroma in the carotid arteries; both were hypertensive, and one had intermittent claudication due to peripheral arterial disease.

5. Carotid ultrasound findings

The ultrasonographic findings in the carotid arteries for the two patient subpopulations are summarized in Fig. 4.

In the group with normal vertebral arteries, 42% also had normal carotid arteries. The remainder of this subpopulation showed a broad distribution in terms of degree of stenosis, with an average of 25%. Eight patients in this group were referred to a surgeon because of a carotid stenosis of more than 60%.

In the group with abnormal vertebral arteries, there was a shift to greater degrees of carotid stenosis, with an average of 42%. However, only one patient in this group was referred to a surgeon because of a stenosis of more than 60%.

An antiplatelet aggregant was suggested, except when contraindicated, for all patients in this diabetic population found to have a carotid atheroma (more than 0%) on cervical artery ultrasound imaging.

6. Vertebrsubclavian ultrasound findings

Pathological ultrasound findings in the vertebral or subclavian arteries were observed in only 48 of the 760 studied diabetic patients. Of these 48, the patient with the subclavian steel syndrome was included in our population of asymptomatic diabetic patients only because the initial clinical examination did not mention the anisotension observed in this patient. Findings such as hypoplasia and arterial occlusions in 17 other patients (groups 1 and 2) did not require any changes to their stroke-prevention procedures. However, 30 patients (group 3) had pathological findings that did necessitate changes to the prevention protocol and most of these patients had associated pathology of the carotid arteries. Any findings in the vertebral or subclavian arteries did not change the prevention procedure in response to the pathological findings in the carotid arteries. Finally, pathological findings limited to the vertebral or subclavian arteries were observed in two patients. Review of their files indicated that these findings did not change their prevention procedure because of the associated hypertension in both patients and the associated peripheral arterial disease in one of them.

7. Discussion

The diabetic population is at risk of cerebrovascular events [5,6] even in cases of newly treated diabetes [7]. The ultrasound imaging findings in extracranial cervical arteries in asymptomatic diabetic patients can lead to four different procedures to prevent stroke:
Fig. 4. Carotid artery stenosis distribution in the studied diabetic population (\(N = 760\)) split into two subpopulations according to the presence of vertebrosubclavian abnormalities (\(N = 48\)) or not (\(N = 712\)).

- no change;
- medical treatment (risk-factor control, antiplatelet agents, statins);
- surgery of a severe carotid artery stenosis;
- an ultrasound imaging survey in cases of moderate carotid artery stenosis [1,5].

Unfortunately, there are no well-defined clinical or biological criteria to identify which diabetic patients will benefit from preventative ultrasound atheroma evaluation [2,6,8–13]. Nevertheless, cervical artery ultrasonography is increasingly being requested by physicians to evaluate a patient’s risk. However, the prevalence of diabetes is so high and its incidence increasing so quickly that it appears to be impractical and time-consuming to perform the complete standard cervical artery ultrasound imaging in each case. One way to save time is to restrict examination to the carotid axis in asymptomatic patients, but this means that the possible consequences of missing other arterial abnormalities need to be evaluated.

The main limitation of our study is that the studied population does not necessarily represent the whole diabetic population. The patients included in this study were diabetics who would benefit from ultrasonography of the extracranial cervical arteries as requested by the diabetes department of our hospital. However, the clinical features of the studied population are similar to those of previous studies [9,14,15]. For example, we found at least two vascular risk factors other than diabetes in more than two-thirds of our diabetic population, which is in accordance with the results of the ECODIA survey [14].

Ultrasound imaging limited to the carotid arteries requires less time than the standard procedure covering all extracranial cerebral arteries. This means that more patients can benefit from carotid ultrasound screening. A truncated ultrasound procedure focused on the carotid arteries is also an opportunity to perform other vascular examinations that might improve vascular risk evaluation [15–18] such as measurement of intima–media thickness. In addition, some emerging methods may provide a more accurate assessment of vascular status and risk evaluation in several chronic diseases. Of the new methods, the two most commonly proposed are flow-mediated vasodilatation and pulse wave velocity [2,5,18].

Our study suggests that ultrasound imaging of the vertebral and subclavian arteries in asymptomatic diabetic patients is of no benefit whatsoever. No pathological findings were identified by cervical artery ultrasound imaging of the vertebral and subclavian arteries in most diabetic patients. In addition, what pathological findings were identified in the vertebral and subclavian arteries of the few remaining patients did not require any changes to their medical prevention procedure for cerebrovascular complications. Thus, we propose that a truncated protocol for cervical artery ultrasound imaging focused solely on the carotid arteries be performed as the first evaluation in diabetic patients who have no cerebrovascular symptoms.

References