INTERNAL CAROTID BLOOD FLOW AND CEREBRAL HEMISPHERIC PERFUSION IN PATIENTS WITH SUBARACHNOID HAEMORRHAGE: A STUDY OF THE QUANTIX/ND™ SYSTEM AND CT PERFUSION TECHNOLOGY

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SUMMARY
Objective: To assess whether carotid blood flow measurements predict abnormalities in cerebral hemispheric perfusion.

Design: The Quantix/ND™ system was used to measure carotid artery blood flow in nine patients with subarachnoid haemorrhage who underwent CT perfusion scanning.

Results: No significant correlation was found between internal carotid artery blood flow and ipsilateral cerebral hemispheric perfusion (0.13, p>0.05) but there was a statistically significant correlation between total internal carotid and global cerebral perfusion (0.63, p<0.05).

Conclusions: This is the first report comparing the Quantix/ND™ system with CT perfusion. Our data do not show a statistically significant correlation between extracranial blood flow and cerebral hemispheric perfusion. This is in contrast to two previous studies where Quantix/ND™ measurements were compared with measurements of cerebral perfusion using the Xenon clearance technique.

Key words: cerebral, perfusion, carotid artery, blood flow, subarachnoid haemorrhage, Quantix/ND™.

RÉSUMÉ
Débit sanguin de la carotide interne et perfusion cérébrale hémisphérique chez les patients atteints d’hémorragie sous-arachnoïdienne : étude du système Quantix/ND™ en scanner de perfusion

Objectif : Déterminer si la mesure du débit carotidien interne (DCI) pourrait prédire les anomalies de la perfusion cérébrale hémisphérique (PCH).

Méthodes : Les patients (n = 9) présentant une hémorragie méningée ont bénéficié d’une mesure de débit sanguin de la carotide interne (Quantix/ND™) au cours de réalisation d’un scanner de perfusion cérébrale.

Résultats : Il n’y avait pas de corrélation significative entre le DCI et PCH (R = 0.13, p > 0.05). Cependant, il y avait une corrélation significative entre DCI et perfusion cérébrale globale (R = 0.63, p < 0.05).

Conclusions : Cette étude, la première à comparer ces deux techniques, ne montre pas de corrélation significative entre le DCI et PCH. Cela est en contraste avec deux études précédentes comparant le Quantix/ND™ et le scanner au xénon.

Mots-clés : perfusion cérébrale, artère carotide, débit sanguin, hémorragie méningée, Quantix/ND™.

INTRODUCTION
Secondary cerebral ischaemia is one of the commonest causes of brain damage in neurosurgical patients. There is, therefore, a need for a user-friendly, portable system that will produce rapid and frequent measurements of cerebral blood flow at the bedside. A new device has been developed that utilizes dual beam, angle-independent pulse-wave Doppler technology (Quantix/ND™, Cardioxonix Ltd.). This system has been reported to provide good measurements of extracranial blood flow in the carotid system [2, 5]. A preliminary study using 28 healthy volunteers and 8 acutely brain injured patients found that measurements of internal carotid blood flow using this system showed a strong correlation with cerebral blood flow measurements using the Xenon clearance technique [1]. A similar pilot study involving 4 patients suffering from subarachnoid haemorrhage found that measurements of internal carotid blood flow appeared to correlate well with cerebral hemispheric blood flow although numbers in the study were too small to draw definite conclusions [3]. The most recently published study involved 15 patients with severe head injury, 4 patients with subarachnoid haemorrhage, and 4 healthy volunteers and found a close linear correlation between blood flow volume measurements with the Xenon clearance technique and internal carotid artery flow measured with the Quantix/ND™ system [5]. This new device warrants further clinical evaluation.

METHODS
Blood flow in the internal carotid arteries of 9 patients suffering from subarachnoid haemorrhage was measured using the Quantix/ND™ system to produce a total of 18 measurements (the...
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QuantixND™ system is shown in figure 1). Near contemporaneous measurements of cerebral blood flow were performed using CT perfusion (Leondardo system, Siemens): internal carotid flow measurements taken immediately before or after CT perfusion studies. To evaluate the effect of angle of the probe with the internal carotid artery and blood flow measurements a series of 5 measurements between 60° and 65° were taken on the single healthy volunteer over a period of 1 minute.

RESULTS

In the series of 9 subarachnoid patients internal carotid artery blood flow mean was 249+/−132ml/min (range: 41-573), internal carotid artery diameter mean was 5.8+/−0.9mm (range: 4.3-7.7), and cerebral perfusion mean was 44.6+/−12.7ml/100ml/min (range: 24.3-71.3). The relationship between internal carotid artery blood flow and ipsilateral cerebral hemispheric perfusion measurements is shown in figure 2 (Pearson correlation coefficient=0.13, p>0.05). The relationship between total internal carotid flow (right and left) and global cerebral perfusion is shown in figure 3 (Pearson correlation coefficient=0.63, p<0.05). The relationship of internal carotid artery diameter with ipsilateral hemispheric perfusion did not show any significant correlation (Pearson correlation coefficient=0.39, p>0.05). However, there was a statistically significant correlation between ipsilateral hemispheric perfusion and internal carotid artery diameter (Pearson correlation coefficient=0.50, p<0.05). It was noteworthy that a small change in angle of the probe produced large changes in the values of blood flow recorded (Pearson correlation coefficient=0.88, p<0.05).

DISCUSSION

This is the first report comparing the Quantix/NDTM system with CT perfusion. We report the largest series of subarachnoid patients to be assessed with the Quantix/NDTM system so far. This is also the first report of the use this technology in a patient with Takayasu’s disease.

Our data do not show a statistically significant correlation between extracranial blood flow and cerebral hemispheric perfusion. However, there is a statistically significant correlation between the total internal carotid blood flow (sum of right and left) and global cerebral perfusion (p<0.05). It is noteworthy that there is also a correlation between hemispheric perfusion and common carotid artery diameter. We have also taken measurements from a patient with Takayasu’s disease.
Although the data were not included in this series for analysis we found that internal carotid flow was highest on the side with the greatest hemispheric perfusion.

Our preliminary experience suggests that this technology is promising. However, we found that a considerable amount of practice was required to obtain reproducible results with the Quantix/NDTM probe. Also, there was considerable variation in internal carotid flow measurements between users, with angle of probe, and with pressure exerted on the internal carotid artery.

CONCLUSION

In view of the potential value of the Quantix/NDTM system in predicting changes in cerebral perfusion at the bedside it is worth pursuing further clinical studies with this technology.

REFERENCES


