Carotid Blood Flow in Paget’s Disease of the Skull
A Study with Electromagnetic Flowmeter*

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Increased vascularity of bone afflicted by Paget’s disease has been noted since the original report by Sir James Paget in 1877. In describing the disease Paget thought that the hyperemia was produced by an inflammatory cause, and hence the term “osteitis deformans” was used. Subsequent pathologic studies have stressed the highly vascular state of the diseased bone and the frequent association of cardiovascular abnormalities. The skull, when involved by the disease, is no exception.

This communication reports the measurement of the blood flow in the carotid artery in 2 patients with Paget’s disease of the skull in whom sarcomatous degeneration had taken place. Prior to resection of the lesion the area of the carotid bifurcation was exposed and measurements of the blood flow were made with an electromagnetic flowmeter (Medicon) before and after ligation of the external carotid artery. Edholm et al. measured blood flow in the nutrient arteries to limbs involved with Paget’s disease using a modified Louis-Grant plethysmograph. They calculated that the blood flow to diseased bone in the tibia might increase up to twenty times the normal value.

Case Reports

Case 1. A 62-year-old longshoreman was admitted with a progressively enlarging mass in the right frontotemporal region which allegedly came on following direct trauma to the area. He also complained of diplopia and diminished hearing. A diagnosis of Paget’s disease of the right femur had been made several years previously.

Examination. Blood pressure was 200/80. There was no evidence of cardiac failure. Radiograms of the skull demonstrated extensive Paget’s disease. There was poor definition of the margins of the right frontal sinus and the lateral rim of the right orbit, suggesting a malignant change. Radiograms of the chest showed the heart and lungs to be normal. Incidental note of Paget’s disease in the left scapula was made.

Right common carotid arteriogram (Fig. 1) revealed a normal intracranial vascular pattern. The branches of the external carotid artery, particularly the middle meningeal, superficial temporal, and occipital arteries, showed marked hypertrophy. The ophthalmic artery also was hypertrophied.

Operation was performed under general anesthesia. Initially the region of the bifurcation of both common carotid arteries was exposed. Recordings of blood flow are illustrated in Fig. 2. With the head in the neutral position the mean flow through the right common carotid artery was 925 cc. per min. With occlusion of the external carotid artery exclusive of the superior thyroid artery the mean flow dropped to 480 cc. per min. Ligation of the superior thyroid artery did not alter this figure. In the left common carotid artery the mean flow measured 760 cc. per min. Following ligation of the external carotid artery the value dropped to 410 cc. Both external carotid

FIG. 1. Case 1. Right carotid arteriogram showing hypertrophy of external carotid branches (arrows).
arteries then were ligated and right frontal craniectomy was performed.

Pathologic examination confirmed the diagnosis of sarcomatous degeneration in Paget’s disease.

Case 2. A 60-year-old salesman complained of a growth on the back of his head of 6 months’ duration.

Examination. The mass was situated in the right occipital region and was bony hard on palpation. He had early papilledema but otherwise no abnormal neurologic signs were noted. Blood pressure was 130/80. Radiograms of the skull revealed marked involvement by Paget’s disease with bony outgrowth into soft tissues in the right occipital region, suggesting sarcomatous degeneration in this area. The skeletal survey revealed involvement of the lumbar vertebrae, pelvis, and left femur by Paget’s disease. Roentgenogram of the chest showed slight enlargement of the heart. A right carotid arteriogram revealed displacement of the branches of the internal carotid artery suggesting a mass in the right occipital region as well as hypertrophy of the occipital artery.

Operation was performed under general anesthesia. The bifurcation of the right common carotid artery was exposed. A mean flow of 770 cc per min. was recorded in the right common carotid artery (Fig. 3). This value dropped to approximately 500 cc. after ligation of the external carotid artery. Bilateral occipital and parietal and suboccipital craniectomy was done with excision of both external and intradural extensions of the tumor.

Pathologic diagnosis confirmed the presence of Paget’s disease with sarcomatous degeneration.

Discussion

The mean blood flow in the common carotid artery has been reported by a number of workers using electromagnetic recording of blood flow in a variety of disease states. Tindall et al. have studied 23 patients undergoing surgery on vessels of the neck for intraarterial administration of a chemotherapeutic agent or treatment of an intracranial aneurysm. The mean common carotid flow ranged from 100 to 610 cc. per min. However, only 1 patient had a value over 500 cc. per min. Mean blood flow in the external carotid artery ranged from 80 to 175 cc. per min. Kristiansen and Krog reported that the blood flow in the common carotid artery was 500 cc. per min. with about 150 cc. passing through the external and 300 cc. through the internal carotid artery. Hardesty et al. in measuring blood flow in patients undergoing radical dissection of the neck found blood flow in the internal carotid artery averaged 364 cc. per min. In 4 patients external carotid flow represented approximately 30 per cent of the common carotid value. In our own series of 7 patients with intracranial aneurysms being treated by carotid ligation, the mean flow in the common carotid artery ranged from 270 to 480 cc. per min. Approximately one-third of this flow entered the external carotid artery.

In both of the cases reported the flow in the common carotid arteries (925, 760 and 770 cc. per min) was significantly higher than has been reported for “normal” flow in the common carotid artery. It is interesting to note that these values are similar to the flow of 845 cc. per min. in the common carotid artery reported by Kristiansen and Krog in a case of carotid-cavernous fistula. In Case 1, in which there was pronounced hypertrophy of the external carotid circulation, the proportion of the flow in this system was approximately 50 per cent of the total flow in