DEMONSTRATION OF COLLATERAL PATHWAYS AFTER SUPERIOR VENA CAVA

OBSTRUCTION WITH THE SCINTILLATION CAMERA

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The scintillation camera has been used in the visualization of blood flow through major vascular systems (1, 2). It has been especially useful in the study of superior vena caval obstruction (3, 4). About 80% of the cases of superior vena caval obstruction are due to malignant tumors of the mediastinum (5), and the remaining 20% are the result of benign causes (6, 7). Obstruction of the superior vena cava leads to the development of collateral channels that transport the venous blood from the upper part of the body to the inferior vena cava and thus aid in the return of blood to the heart. These collateral channels are numerous and are located along the anterior and posterior aspects of the chest and abdomen (8).

The case reported here illustrates the usefulness of the scintillation camera in the demonstration of collateral venous channel formation following superior vena caval obstruction. It would appear that the smaller venous pathways can also be observed with the scintillation camera.

CASE REPORT

The patient, a 59-year-old white male, was in good health until 2 weeks before his admission to Wadsworth Veterans Administration Hospital on May 10, 1969. He noticed swelling of the face and eyelids during the night with gradual persistence during the daytime. Two weeks before his admission his voice became hoarse.

Physical examination revealed a well-built man who appeared chronically ill. The patient's pulse rate was 80/min and regular, and his blood pressure was 130/60. There was pitting edema of the face and eyelids. The neck veins were distended bilaterally. Many cutaneous superficial veins were noted on the upper part of the right side of the chest. The remainder of the physical examination revealed no significant abnormalities.

Radiographs of the chest showed a large mass in the upper part of the right lung. Sputum cytology revealed poorly differentiated malignant cells of the squamous cell type.

Radioisotope venography performed with the scintillation camera using 99mTc-sodium pertechnetate showed bilateral complete obstruction of both innominate veins. There were superficial cutaneous collateral veins on the right side, but no evidence of collateral veins on the left. On the left side, because of innominate vein obstruction, the radioisotope tracer was seen to reflux into the internal jugular vein (Fig. 1).

Radiographic venography with diatroizoate showed complete obstruction of the innominate veins and confirmed the abnormalities observed with radioisotope venography.

Radiation therapy with 60Co was started on June 2, 1969. After 15 days of therapy swelling in the face subsided, and the patient appeared improved. It was not clear whether or not the observed clinical improvement was a response to radiation therapy with an associated decrease in the size of the tumor mass in the chest releasing pressure over the great veins. Formation of new collateral venous drainage from the upper part of the body was considered. Repeat radiographic venography at this stage was not indicated because of the patient's clinical condition. The patient's course was therefore followed by radioisotope venography. Serial studies demonstrated the development of collateral venous pathways. The last study was done 10 days before the patient's death.

Technique. Radioisotope venography was done by the bilateral intravenous injection of 99mTc-per-
The patient died 10 days after the last study. At autopsy it was noted that the tumor mass completely obstructed the superior vena cava. The thrombus extended into both innominate veins. The two internal mammary veins were dilated, and there were anastomoses with the inferior epigastric veins on both sides, confirming the scintillation camera studies. Most of the blood from the upper part of the body was returned to the heart by this route (Fig. 3).

**DISCUSSION**

It is generally accepted that the scintillation camera is useful primarily for the study of the superior and inferior vena cavae and their major tributaries. It is suggested that the scintillation camera superior vena caval study be considered as a screening procedure (3). The case reported here demonstrates that it can be used for the study of the smaller veins.

It is very essential in assessing the prognosis of a patient with vena caval obstruction to establish the presence of collateral venous pathways and to avoid radiation therapy damage to the collaterals. Sometimes, as in this case, the disappearance of facial edema may falsely suggest a beneficial therapeutic response. A simple and nontraumatic procedure such as the use of a radiotracer and the scintillation camera may be very useful in establishing the actual

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**FIG. 1.** Bilateral radiographic venography (upper A and B) demonstrates obstruction of innominate veins on both sides (arrows). Venography with $^{99m}$Tc-pertechnetate and scintillation camera (lower A and B) confirms bilateral innominate vein obstruction (arrows). On right side (lower A) cutaneous venous collaterals are seen. No collateral veins are seen on left side (lower B). Reflux of radioisotope into left jugular vein is evident. (During this study $^{99m}$Tc was injected separately on each side.)

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**FIG. 2.** Scintillation camera study done 10 days before death by injecting 10 mCi of $^{99m}$Tc-pertechnetate into antecubital veins bilaterally shows tracer material flowing down both sides of sternum in internal mammary veins (IMV). Anastomoses with corresponding inferior epigastric veins (IEV) is clearly seen.
injections required for contrast material venograms. The mobility of the detector head of the scintillation camera also permits the use of this technique in severely sick patients.

CONCLUSION

Collateral pathways through the internal mammary and inferior epigastric veins after superior vena caval obstruction has been demonstrated with the scintillation camera. It is concluded that the scintillation camera can be used to study venous obstruction and to evaluate the patency of small veins, such as the internal mammary. There is no discomfort from the technetium superior venacavography, whereas there is marked patient discomfort and increased hazard with venous angiography in the presence of severe venacaval obstruction.

REFERENCES