A Phased Array Coil Optimized for Carotid Artery Imaging

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**Introduction**

Carotid artery atherosclerotic disease is a major etiologic factor for the development of stroke. A number of studies have shown a high positive correlation between significant carotid stenoses and the development of stroke. The impact of these studies has been to perform carotid endarterectomy in most patients with carotid artery stenoses of greater than 70%. In addition, there are a number of research studies that are looking at the ability of MRI to characterize atherosclerotic plaque. None of the commercially available coils that are currently used for carotid artery imaging are optimized for the carotid artery. Instead, these coils are built for multiple purposes such as imaging the entire head and neck. The purpose of this study was to evaluate the performance of a carotid coil designed specifically for imaging the carotid arteries.

**Materials and Methods**

The carotid arteries are long and narrow and for the most part lie near the skin’s surface. This situation is ideally suited for surface coil imaging. A dedicated 6-element phased array coil was developed for imaging the carotid arteries (Scan Med, Omaha, NE). The coil is flexible, lies on the patient’s sternum, wraps around the anterior part of the neck, and extends superiorly on either side of the head. (Fig. 1) The superior 4 elements are circular and 4 inches in diameter. The anterior neck element is approximately 4 x 6 cm and the sternal element is 5 x 8 cm. The superior 4 elements are multiplexed to two channels so that the coil can operate on a scanner with 4 receivers.

The dedicated carotid coil was compared with a general purpose neurovascular birdcage coil (Medrad). Gated 2D-TOF carotid MRA was performed on 3 normal volunteers on a 1.5 T GE Echospeed scanner. The following parameters were used: TR/TE 19.6/4.7 ms, matrix 256x192, flip angle 60°, bandwidth ± 62 kHz, FOV 28 x 12.6 cm, slice thickness 1.4 mm, 34 slices.

**Results**

Figure 2 shows that images from the dedicated carotid coil (①) have a higher SNR than those from the general purpose neurovascular coil (②). At the carotid bifurcation where most disease occurs, it is approximately 3-fold higher.

![Figure 2](image)

Discussion

This study demonstrates that a dedicated carotid coil significantly improves the signal to noise ratio of the carotid artery. This can be used for acquiring higher resolution images to better show the degree of carotid artery stenosis. In addition to improved SNR, the dedicated coil is smaller and offers a degree of openness preferred by most patients over enclosed volume coils.

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