OBSERVATIONS ON THE USE OF TANTALUM FOIL IN PERIPHERAL NERVE SURGERY*

NATHAN CROSBY NORCROSS, M.D., † AND JOHN T. BAKODY, M.D.‡

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Because the metal tantalum was found to be biologically inert,¹ and could be rolled into a thin foil, it was chosen as an ideal material to wrap as a cuff about a nerve suture site. It was advocated by Spurling,²,³ who emphasized the undesirable role played by extrinsic scar at the site of nerve sutures. He believed that fixation and scarring of the repaired nerve could be reduced to a minimum by the judicious use of tantalum foil as a protective sheath. White and Hamlin⁴ found that unannealed tantalum foil tended to break up considerably and felt that annealed foil was more desirable when foil was used to protect the line of anastomosis. They also used it in wrapping the end of a severed nerve, hoping thereby to prevent neuroma formation. Cuffs of tantalum foil have been used to wrap the severed sympathetic trunks in cases of sympathectomy, with the hope that regeneration of the sympathetic fibres would be prevented thereby.

We are reporting the findings in 20 cases of peripheral nerve suture and lysis in which unannealed tantalum foil cuffs were used and subsequently removed and the surgical pathology observed and recorded. The foil was removed after periods varying from 6 weeks to 6 months.

We employed cuffs of #101 unannealed tantalum foil, of sufficient length to extend approximately 1 inch above and below the suture site. The foil was sterilized while wrapped around a glass tube and was thus already curled when used. The cuff was made by wrapping the foil around the nerve with a small amount of overlap; the foil was then secured with 2 ties of 00 plain catgut.

On the basis of our observations, the use of tantalum foil cuffs presents the following advantages:

(a) Insulation of the suture site so that extraneous tissue is prevented from entering the site of junction. If the foil does not fragment, the suture site is protected.

(b) Prevention of fixation of the suture site, but see (a) below.

(c) Prevention of escape of regenerating axons at the suture site.

(d) Making the secondary operation easier through prevention of fixation of the suture site and easy accessibility of that site.

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† Released from active duty, United States Navy, on December 15, 1945. Now at 400-29th St., Oakland 9, California.

‡ Released from active duty, United States Navy, on March 15, 1946. Now at 1304-46th St., Des Moines, Iowa.

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Unfortunately, the following disadvantages were encountered:

(a) Scarring at upper and lower limits of the cuff. This is extraneural and involves the epineurium to act as a constricting ring.
(b) Fragmentation of the foil with intense extraneural scarring and adherence of the foil particles to the epineurium.
(c) Attenuation of the epineurium in the portion of the nerve just beyond the confines of the cuff, making suture difficult if resection of that portion of the nerve protected by the cuff is deemed necessary. (We do not understand the mechanism of this finding, but have encountered it repeatedly.)
(d) Gradual contraction of the fibrous envelope about the cuff, causing progressive constriction of the nerve.

The following excerpts were taken from the operative protocols:

(1) Could not remove foil without sacrificing the nerve.
(2) The tantalum cuff was densely incorporated into a fibrous sheath which was constricting the nerve at the two points where black silk sutures* had been passed about the cuff to secure it. At these points, the foil was scarred into the nerve substance; elsewhere, the underlying nerve was intact.
(3) Band adhesions at the proximal and distal ends of the cuff.
(4) Constricting bands at each end of the cuff. Peroneal division had foil adherent to the nerve throughout, which had to be dissected piecemeal from the nerve.
(5) Tantalum cuff was wrinkled and tightly adherent to the nerve.
(6) Nerve had adhered to the tantalum foil in many places. The foil had to be removed piecemeal. Circular bands of scarring at the proximal and distal ends of the foil.
(7) The median nerve was exposed and a cuff of tantalum foil dissected free from the surrounding scar tissue to which it was adherent. The foil cuff was wrinkled but intact, and after removal an internal and external capsule could be demonstrated. While the foil had protected the nerve from the external scar tissue, the tantalum cuff was itself adherent to the external scar tissue.
(8) The position of the nerve which had been covered with a cuff of tantalum foil was enclosed in a fibrous capsule, densely adherent to the foil, and loosely adherent to the adnexal tissue. The tantalum foil was brittle and fragmented upon manipulation. Dense fibrous bands were dissected free from the upper and lower limits of the foil. Several transverse constricting bands were incised. The tantalum foil in this case constituted a definite disability to the nerve. Constriction between nerve and cuff could be demonstrated.
(9) The tantalum foil was enclosed in fibrous capsule and was constricting the nerve. There was considerable fibrosis at the upper and lower limits of the cuff.
(10) The cuff of tantalum foil was found intact and surrounded by dense scar which was constricting the nerve at both ends of the cuff.
(11) The entire area of the sutured peroneal nerve surrounded by tantalum foil was so scarred and the foil so intimately incorporated with the nerve that the entire area had to be resected en bloc and a fresh end-to-end anastomosis carried out.

The story is bad enough, but not wholly so. In many cases, especially in those where the foil had been removed early, the suture site was found to have been excellently protected, and the anastomosis grossly desirable. In most instances the foil did insulate the suture site and prevent the ingrowth

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* This tantalum cuff had been applied elsewhere. It was not our technique to use silk sutures in securing these cuffs, but fine catgut.