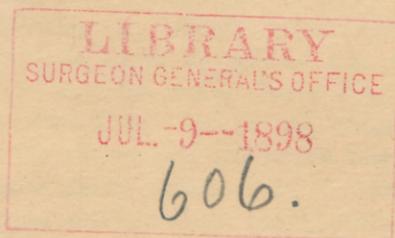


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A NEW METHOD OF NERVE RESECTION FOR AMPUTATION-NEUROMA.

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Neuroma, as a remote complication of amputation, appears in the form of a bulbous enlargement of the end of the principal nerve or nerves in the stump. Such a tumor usually makes its appearance a few weeks or months after the operation, and is the most frequent cause of painful stumps. The usually accepted theory attributes the enlargement of a nerve-end in amputation-neuroma to an abundant formation of small myelinic fibers produced from the neuroblasts which have been exposed for a long time to irritation caused by cicatricial tissue. It is well-known that an amputation-neuroma will only develop in connection with scar tissue and the irritation incident to the condition producing it. Every amputation-neuroma will be found imbedded in more or less of scar tissue. Witzel has recently shown that in many cases the neuroma is found attached to the end of the bud in the stump. It is more than probable that the cut ends of the nerve fibers become attached to the scar tissue which acts the part of a foreign substance and excites the active and abnormal tissue proliferation upon which depends the formation of the neuroma. The tumor presents itself in the form of a bulbous enlargement of the end of the nerve, which closely resembles a spring onion in outline. Cross-sections of such tumors show the numerical increase of myelinic nerve fibers. Nicoladoni's assistant has made some very interesting investigations regarding the structure of amputation-neuroma and has come to the conclusion that the numerical increase of nerve fibers is apparent and not real. According to his observations the increase is due to the formation of loops growing out of the elongation of the pre-existing fibers.

Virchow called attention to such a possibility years ago and emphasized particularly the difficulty in following out and tracing the nerve fibers. It is very desirable that future research

should settle this question definitely. With the proliferation or growth of the nerve fibers the interstitial connective tissue is increased under the same influence, the resulting tumor constituting histologically a true neurofibroma.

Within a short time the tumor as a rule reaches its maximum size, seldom exceeding twice the circumference of the nerve trunk, when it becomes stationary and manifests little or no tendency to degenerative processes. In the majority of cases the tumor is limited and forms the bulbous extremity of the nerve; in some instances, as in the case reported by Hayem and Gilbert, the nerve is at the same time enlarged for a considerable distance above the tumor, the enlargement being due to an abundant formation of interstitial connective tissue. Every surgeon of large experience knows that an amputation-neuroma in some cases is exceedingly prone to return after excision, and these are undoubtedly the cases in which the nerve is enlarged far beyond the bulbous extremity. The writer has known instances in which such neuromata were excised four and five times, and an early return of the pain, with recurrence of the tumor followed each operation. In one case a cure was finally effected by excising four inches of the sciatic nerve, far beyond the apparent limits of the tumor and enlargement of the nerve. Neuroma is more apt to appear in persons the subjects of an inherited or acquired predisposition to the active proliferation of the elements of which a nerve is composed more especially the presence in the injured nerve of an abnormal abundance of potential neuroblasts.

Virchow, in speaking of the etiology of neuromata, very properly alludes to such a general aptitude which he terms neuroblasty, or neuromatosis. A surgeon performs two amputations for the same conditions and under the same circumstances, following the same technique and dealing with the same structures, in one the nerve ends become implicated, in the other they escape. The one who subsequently suffers from neuroma must necessarily have furnished the essential conditions for the development of this remote complication which were inadequate or absent in the other. Amputation-neuroma has become less frequent since surgeons have become aware of the fact that the exciting cause is always scar tissue formed around the end of the cut nerve. Excising the principal nerves a considerable distance above the level of the wound and primary wound healing under aseptic precautions have succeeded in diminishing the frequency but not in preventing with certainty the occurrence of

neuroma after amputation. Amputation-neuroma will continue to appear in the practice of the most careful and painstaking surgeons. The frequency with which such tumors recur after ordinary excision as generally practiced is well-known.

The writer has seen a number of such cases in which excision was performed from four to six times by different operators without permanent relief. For nearly three years he has adopted a method of excision which has proved eminently successful in preventing recurrence. In several instances this procedure proved permanently satisfactory in which repeated excision had been followed by speedy recurrences. Recognizing the fact that neuroma, after amputation, always develops in connection with scar tissue and is undoubtedly the result of irritation of the cut ends of the fibers incorporated in the scar tissue, the writer was induced to excise the nerve at a safe distance from the tumor in a manner that would prevent such an occurrence by bringing the cut ends of the nerve fibers in contact and by interposing between them and the scar tissue the normal covering of the nerve—the nerve-sheath. After dissecting up the scar tissue in connection with the neuroma the nerve is liberated to the requisite extent and excised at a safe distance from the tumor by making a V-shaped incision forming a wedge on the part of the nerve removed and two small flaps on the proximal end. These little flaps, according to the size of the nerve, are brought together by one to three fine cat-gut sutures which gives the nerve end a conical shape. In nerves of the size of the median, ulnar and musculo-spiral, one suture at the apex of the cone answers the purpose. In operations on the sciatic nerve one terminal and two lateral sutures are necessary. This method of nerve resection furnishes absolute protection to the nerve fibers against irritation on the part of scar tissue and interposes between the nerve fibers and the scar tissue resulting from the operation the normal protection of the nerve—the nerve sheath. In case it becomes necessary to operate on two nerves in close proximity the same object is obtained by suturing the nerve ends together after excision of the neuromata. As an additional precaution the nerve end can be further protected by covering it with adjacent muscle tissue by a few points of buried absorbable sutures before closing the external wound.

