# CONCERNING THE GANGLIFORM ENLARGEMENT ('PSEUDOGANGLION') ON THE NERVE TO THE TERES MINOR MUSCLE

By GERSHON GITLIN

*Department of Anatomy, The Hebrew University-Hadassah Medical School, Jerusalem, Israel*

An oval swelling on the nerve to the teres minor muscle is mentioned in a number of standard anatomical texts and is variously termed a 'gangliform enlargement' (Schaeffer, 1942; Brash, 1949) or 'pseudoganglion' (Johnston & Whillis, 1949). A gangliform enlargement is described also near the terminal bifurcation of the median nerve (Jones, 1953), at the termination of the dorsal interosseous nerve of the forearm and on the lateral terminal branch of the anterior tibial nerve. The swellings on the latter three nerves are in close contact with ligamentous, tendinous or bony structures; in the case of the swelling on the nerve to the teres minor no similar relationship is apparent at first sight nor is any such relationship referred to in the above-mentioned texts.

The present work was undertaken to study the form and relations of this swelling and also some aspects of its microscopic structure.

## MATERIALS AND METHODS

(*a*) *Macroscopic findings* are based on thirty-six dissections; thirty of these were in adult dissecting room cadavers and the remainder in adult autopsy cases.

(*b*) *Microscopic examination* was directed towards:

(i) Ascertaining the types of cells present in the enlargements. Five specimens from autopsy cases were examined, technique consisting of fixation in Bouin's solution or formalin, embedding in paraffin and staining with hematoxylin and eosin.

(ii) Comparing the amount of connective tissue in the enlargements with that in the nerves immediately proximal to the enlargements. The relative cross-sectional area, in these two regions, of the epineurium, perineurium and nerve fibre fasciculi (i.e. endoneurium plus nerve fibres) was determined by making projection drawings of microscopic sections on millimetre squared paper (Sunderland & Bradley (1949), slightly modified); a total of four specimens was used. Histological technique was as in (i).

With regard to the endoneurium itself, a better indication of the amount present in an enlargement, as compared with that in the nerve proximal to the enlargement, was obtained from azan-stained sections. Sections from the two regions were examined simultaneously by means of a Bausch & Lomb comparison eyepiece.

## OBSERVATIONS

(*a*) *Macroscopic findings* (Fig. 1, Table 1)

In outline the findings were as follows:

(i) An elongated, fusiform swelling was found along the course of the nerve in twenty-one of the thirty-six specimens dissected.

(ii) In five specimens the nerve to the teres minor was found to be distinctly broad but the broadening was not fusiform in shape.

(iii) In the remaining ten cases neither fusiform swelling nor any other form of broadening of the nerve was observed.

Table 1. *Data from dissections of the nerve to the teres minor*

| | No. of cases | Relationship of nerve to teres minor to long head of triceps | |
|---|---|---|---|
| | | Curving round | Lying alongside |
| Fusiform swelling of nerve present | 21 | 20 | 1 |
| Broadening of nerve present, not fusiform in shape | 5 | 4 | 1 |
| Neither fusiform swelling nor other form of broadening of nerve present* | 10 | 4 | 7 |

* In one of these cases two branches proceeded to the teres minor, one lying alongside and the other curving round the long head of the triceps. Each of these is entered separately in the two right-hand columns of the table, hence the discrepancy in the figures.

(i) *The fusiform swelling*, when present, was approximately 12–20 mm. long and 2·5–4·0 mm. wide; it was flattened to a degree varying from case to case. Its commencement along the course of the nerve was gradual and it terminated, after gradually narrowing again, by giving off branches to the teres minor. In no case did the swelling take the form of a small, sharply circumscribed enlargement such as illustrated by Brash (1949, fig. 46), Jones (1953, fig. 280) and Mitchell & Patterson (1954, fig. 74). In one instance the narrowing distal to the fusiform swelling was succeeded by a second slight swelling from which arose the terminal branches supplying the teres minor. In one other case the gangliform enlargement was seen to be split longitudinally, but unequally, into two; each part, after narrowing, gave branches to the teres minor.

In a small number of cases the fusiform enlargement involved not only the nerve to the teres minor itself but the whole of the posterior division of the circumflex nerve. In these cases muscular branches to the deltoid and also a cutaneous branch were seen to come off the swelling.

*Relations.* The nerve to the teres minor (or the posterior branch of the circumflex nerve) was seen to arise from the superior aspect of the circumflex nerve deep in the quadrilateral space. In twenty of the twenty-one cases in which the fusiform swelling was present, the nerve at the site of the swelling performed a distinct curve round the lateral aspect of the upper part of the long head of the triceps, being closely applied to it; in this region the long head of the triceps is still distinctly tendinous on its surface. One of the terminal branches of the nerve to the teres minor frequently continued the curvature of the nerve as shown in Fig. 1. The capsule of the shoulder joint was related to the outer convex aspect of the nerve, but the relationship was

not nearly as intimate as that between the nerve and the tendon of the long head of the triceps; a variable quantity of fatty loose connective tissue was found between the nerve and the joint capsule. The relationship of the nerve to the surgical neck of the humerus was also not close.

In the one exceptional case the fusiform swelling was observed not to curve round the tendon of the long head of the triceps but to lie alongside its lateral aspect.

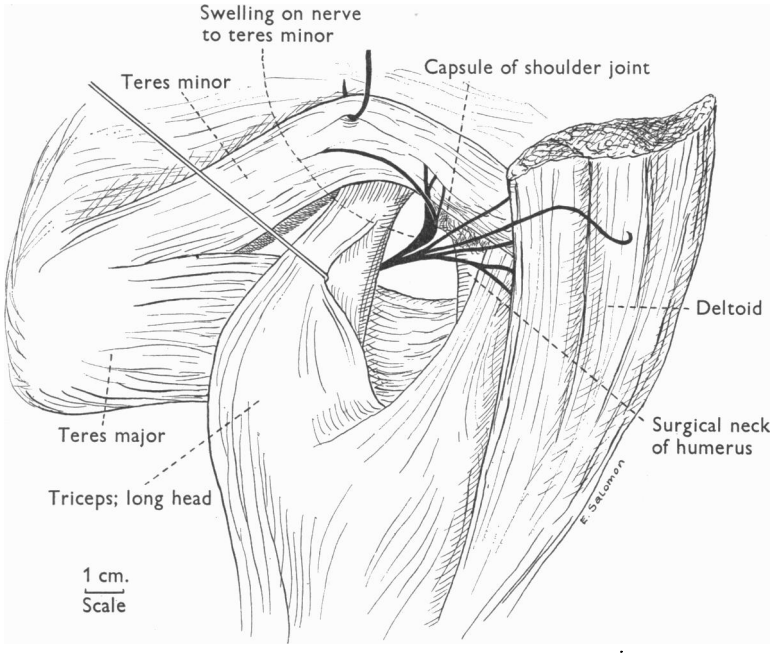


**Fig. 1. Dissection showing a typical 'gangliform' enlargement on the nerve to the teres minor. The nerve at the site of the enlargement curved round the lateral aspect of the upper part of the long head of the triceps and was closely applied to it. The long head of the triceps has here been drawn medialwards.**

(ii) In the five cases in which a *broadening—not fusiform in shape*—was present, its form, in four instances, was such that the nerve to the teres minor expanded as it passed dorsally, but did not narrow again before giving its terminal branches to the muscle. In the fifth case the nerve was broad at its origin and narrowed before entering the teres minor.

The relationship of these broadenings to the long head of the triceps is indicated in Table 1.

(iii) In the ten cases in which *no swelling was evident* it was found that in six instances the nerve passed supero-laterally directly to the teres minor, lying alongside the tendon of the long head of the triceps but not curving round it. In three instances it did curve round the tendon as described above.

In the remaining case two nerves to the teres minor were present; one of these lay alongside the tendon of the long head of the triceps while the other curved round the tendon.

(*b*) *Microscopic findings*

(i) The types of cells seen in sections of the enlargement were the same as those seen in peripheral nerves generally and in sections of the nerve to the teres minor proximal to an enlargement.

No ganglion cells were observed.

(ii) The absolute cross-sectional area of epineurium, perineurium and nerve fibre fasciculi (i.e. endoneurium plus nerve fibres) was, in each instance, markedly greater in the gangliform enlargement than in the nerve proximal to the enlargement. The percentage of the total area occupied by each of these components was different in the gangliform enlargement from that in the nerve proximal to the enlargement, but the number of specimens examined was too small for adequate statistical analysis.

The azan-stained sections showed that the quantity of intrafascicular collagenous material was greater in the enlargements than in the nerves proximal to the enlargements.

## DISCUSSION

It would appear from the microscopic examination of the swellings on the nerve to the teres minor that they are due to the presence of relatively more connective tissue than is present in the nerves proximal to the swellings.

Dissection revealed that frequently the nerve curved round the lateral aspect of the upper, tendinous part of the long head of the triceps and was intimately applied to it. It may be seen from Table 1 that of the twenty-eight cases in which the nerve was in this fashion related to the triceps, twenty-four showed either a fusiform enlargement or a broadening, not fusiform in shape. It is possible that this intimate contact with the long head of the triceps bears a causal relationship to the presence of the swelling on the nerve; during muscular activity it is likely that friction occurs between the nerve and the tendon and that pressure is exerted on the nerve.

Why in a small number of instances the same intimate relationship to the tendon of the long head of the triceps was unaccompanied by a thickening or widening of the nerve may only be surmised. It is possible that individual differences exist in the degree of connective tissue reactions to mechanical forces. Such individual differences may explain also those two cases in which a widening of the nerve was present, but in which the nerve did not curve round the tendon of the long head of the triceps (Table 1). The nerves in these two cases simply lay alongside the tendon, and it is possible that a lesser degree of friction was sufficient to evoke a connective tissue hyperplasia.

## SUMMARY

In thirty-six dissections of the nerve to the teres minor a fusiform swelling along its course was found in twenty-one instances and a broadening of the nerve, not fusiform in shape, in five instances. In twenty-four of these twenty-six cases the nerve, at the site of its enlargement, curved round the lateral aspect of the upper, tendinous part of the long head of the triceps, being closely applied to it.

On histological examination it was found that the cell types present in fusiform enlargements were the same as those seen in peripheral nerves generally. No ganglion cells were observed. The amount of connective tissue in enlargements was

considerably greater than in nerves proximal to the enlargements, the increase affecting epineurium, perineurium and endoneurium.

The possibility is discussed of the intimate contact between the nerve and the long head of the triceps bearing a causal relationship to the development of this increased amount of connective tissue, and thus to the presence of an enlargement along the course of the nerve.

The author wishes to thank Prof. M. Ickowicz for advice and assistance in connexion with the histological aspects of this work; Prof. H. Ungar and his staff for facilities provided in obtaining post mortem specimens; Mrs E. Salomon for the drawing of Fig. 1 and for the projection drawings; Miss T. Daskal, Mr I. Hayoun and Mr A. Welner for technical assistance.

## REFERENCES

BRASH, J. C. (1949). *Cunningham's Manual of Practical Anatomy*, 11th ed. vol. I. London: Oxford University Press.

JOHNSTON, T. B. & WHILLIS, J. (1949). *Gray's Anatomy*, 30th ed. London: Longmans, Green and Co.

JONES, F. WOOD (1953). *Buchanan's Manual of Anatomy*, 8th ed. London: Baillière, Tindall and Cox.

MITCHELL, G. A. G. & PATTERSON, E. L. (1954). *Basic Anatomy*. Edinburgh and London: E. and S. Livingstone Ltd.

SCHAEFFER, J. PARSONS (1942). *Morris' Human Anatomy*, 10th ed. Philadelphia: The Blakiston Company.

SUNDERLAND, S. & BRADLEY, C. K. (1949). The cross-sectional area of peripheral nerve trunks devoted to nerve fibres. *Brain*, **72**, 428–449.