THE BLOOD SUPPLY OF NERVES

II. THE EFFECTS OF EXCLUSION OF ITS REGIONAL SOURCES OF SUPPLY ON THE SCIATIC NERVE OF THE RABBIT

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The probability that a constant and adequate supply of blood is not the least of the essential functional requirements of a nerve (see Adams, 1942) immediately leads us to inquire: Is a nerve, then, more dependent on its regional or on its longitudinal sources of supply? In the literature, apart from Koch (1926) who was reluctant to consider the regional sources as indispensable, I can find only one other investigator who has considered this problem: Okada (1905) has affirmed that occlusion (by ligation) of a single nutrient artery results in degeneration of the nerve which it supplies. This is a significant thesis and is entitled to our most serious consideration for, if degeneration may thus supervene in a nerve whose axis cylinders retain anatomical continuity with their cell bodies, it would be necessary in many cases to dissociate *ischaemic* from Wallerian degeneration; and again, if such degeneration be substantiated, we might reasonably anticipate comparable effects whenever a length of nerve is mobilized without regard for its nutrient vessels. Moreover, in the repair of certain lesions of peripheral nerves where separation of a nerve from some of its regional sources of supply must frequently occur, there is a possibility of serious impairment of the normal process of regeneration in both the central and peripheral stumps. From every angle, whether it be the normal functioning of intact peripheral nerves or one of the many related surgical and medical problems, the subject is clearly one of considerable interest.

Let us then examine briefly the relevant evidence. Okada studied the effects, in the rabbit's sciatic nerve, of ligation of the inferior gluteal artery above the origin of its nutrient branch, the arteria 'comitans' nervi ischiadici, which—although admitting that it is not the only vessel supplying the nerve—he regarded as the 'largest, the most significant and the most constant of all the arteries of this nerve'. Those other vessels, however, which contribute to the intraneural plexus of the sciatic nerve are by no means as insignificant as he would suggest; indeed, they may be even more important than the inferior gluteal (Koch). In excluding such vessels, therefore, merely because they do not pass directly to the sciatic nerve, Okada has disregarded two established facts: (1) that the division between the sciatic nerve and its branches is purely descriptive since it is well known that the apparent branching of the nerve is reflected in its internal organization long before the individual branches separate; and (2) that the intrinsic vessels of the main sciatic nerve are quite continuous, anatomically and physiologically, with those of its 'terminal' branches. So, in view of this vascular and nervous continuity between the sciatic nerve and its branches, the adoption of a rigid line of demarcation between them is, to say the least, liable to be very misleading, for vessels which undoubtedly contribute to the total vascularity of the nerve may thus be ignored simply because they reach it, not directly, but by way of its branches.

Careful consideration of the operative technique is essential if we wish to assess accurately the results of such an experiment. The inferior gluteal artery is not difficult to identify; on the other hand, it is not easy to ligate it above its upper nutrient ramus (Okada disregards the fact that there are generally two such branches) without damaging the nerve, because the artery, lying under cover not only of the sciatic nerve but also of the inferior gluteal vein and the nerve to femoro-coccygeus muscle, is usually relatively inaccessible at this level. Okada says that the nerve 'was detached from its bed in order to dispose of any other sources of supply difficult to identify' although 'strictly avoiding any injury to the nerve'. Whether this was a routine procedure is not quite clear, but where it is specified we cannot disregard it for possibility of injury to the nerve can only be certainly excluded by avoiding it altogether. Okada ligated the inferior gluteal artery in fourteen cases, in four of which he records quite definitely that he separated the nerve from surrounding structures; the inadequate description of his operative procedure, however, does not help to dispel the suspicion that in his other animals also some manipulation of the nerve might possibly have taken place.

Although there are many other points which might be criticized, Okada has undoubtedly produced evidence of degeneration in the majority of his cases. His animals were left after operation for periods varying from 4 to 111 days. The animal killed after 4 days showed very few degenerated fibres, but by the 5th and 6th days degeneration was more evident; subsequently degenerated fibres predominated and in many cases the nerve was completely degenerated. He studied the changes in the medullary sheaths by teasing after staining with osmic acid and by the Marchi method, while those in the axis cylinders were investigated by the van Gieson technique, a method which certainly does not favour his claim to have observed regeneration of fibres in some of his longer experiments.

The clinical signs were merely summarized and were not correlated with the histological changes; they are frequently unconvincing. Thus, in spite of the complete degeneration of the sciatic nerve which was often obtained, total paralysis of the leg was never observed; and in view of the results obtained by Gutman & Guttman (Gutman, Guttmann, Medawar & Young, 1942) in lesions of the peroneal nerve alone, the extent of analgesia seems rather restricted for the extensive disturbance of the sciatic nerve which Okada claimed to have produced.

His results, therefore, although certainly dramatic, are not by themselves entirely convincing, and they require independent confirmation. For that reason I have repeated the original experiment and carried out a further elaboration, viz. a study of the effects of occlusion of *several* sources of supply of the sciatic nerve. The present paper records the results of these experiments.

MATERIAL AND METHODS

For convenience the rabbit was again used. A careful investigation was first made of the vascular connexions, in the thigh, of the sciatic nerve and its branches (Text-fig. 1). Apart from minor variations, three principal sources of blood supply were identifiable:

1. *Proximal.* Soon after it enters the thigh from the pelvis the sciatic nerve receives a slender branch or branches from the inferior gluteal artery; generally they are two in number and pass laterally from the artery to the nerve. Since the artery progressively diverges from the nerve, the lower of the two nutrient arteries is the longer and (in accordance with Bartholdy's dictum, 1897) is also the larger—it is this vessel presumably which has been called the arteria 'comitans' nervi ischiadici. The two nutrient arteries approach the medial side of the nerve a short distance below the pyriformis muscle and divide on its surface into ascending and descending rami (usually multiple) of which the latter are the larger. The ascending rami, of the upper nutrient artery especially, anastomose with small vessels which accompany the sciatic nerve from the pelvis. Thus the continuity of the intraneural plexus is maintained. The principal descending ramus of the lower nutrient artery passes down not with the sciatic nerve but with its branch to the hamstring group of muscles, although during its course with the latter it provides branches which run transversely outwards to rejoin the main nerve, again dividing there into ascending and descending rami.

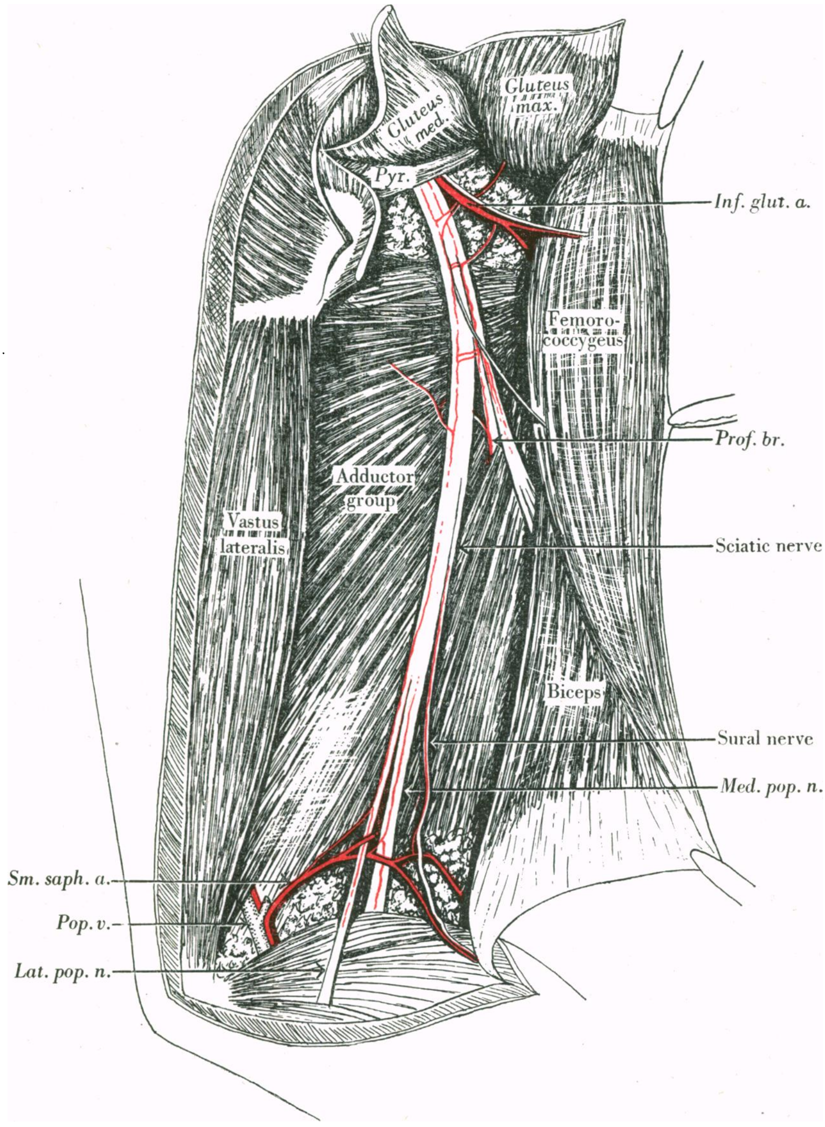
2. *Intermediate.* A small artery, a perforating branch of the profunda femoris artery, reaches the back of the thigh in company with the nerve to the adductor magnus muscle. It generally reaches the sciatic nerve at its medial side, dividing as usual into ascending and descending rami of which the former anastomoses with the descending rami of the proximal source. Occasionally (as in Text-fig. 1) this nutrient vessel joins a very slender vessel which appears through the adductor longus muscle, and finally reaches the nerve at its lateral side.

3. *Distal.* The distal supply is derived entirely, by slender ascending branches, from the small saphenous artery. These nutrient arteries are invariably three in number and accompany the medial and lateral popliteal and sural nerves (Pl. 1, fig. 1). They ascend for some distance on the surface of these nerves before piercing the epineurium and disappearing into the interfascicular connective tissue; they obviously contribute to the intraneural plexus of the sciatic nerve and in this way communicate with the intermediate and proximal sources of supply.

The veins draining the sciatic nerve always accompany the arteries; they are more obvious than the latter owing to their larger calibre, and where this is increased, as under nembutal anaesthesia, they tend to dominate the vascular picture.

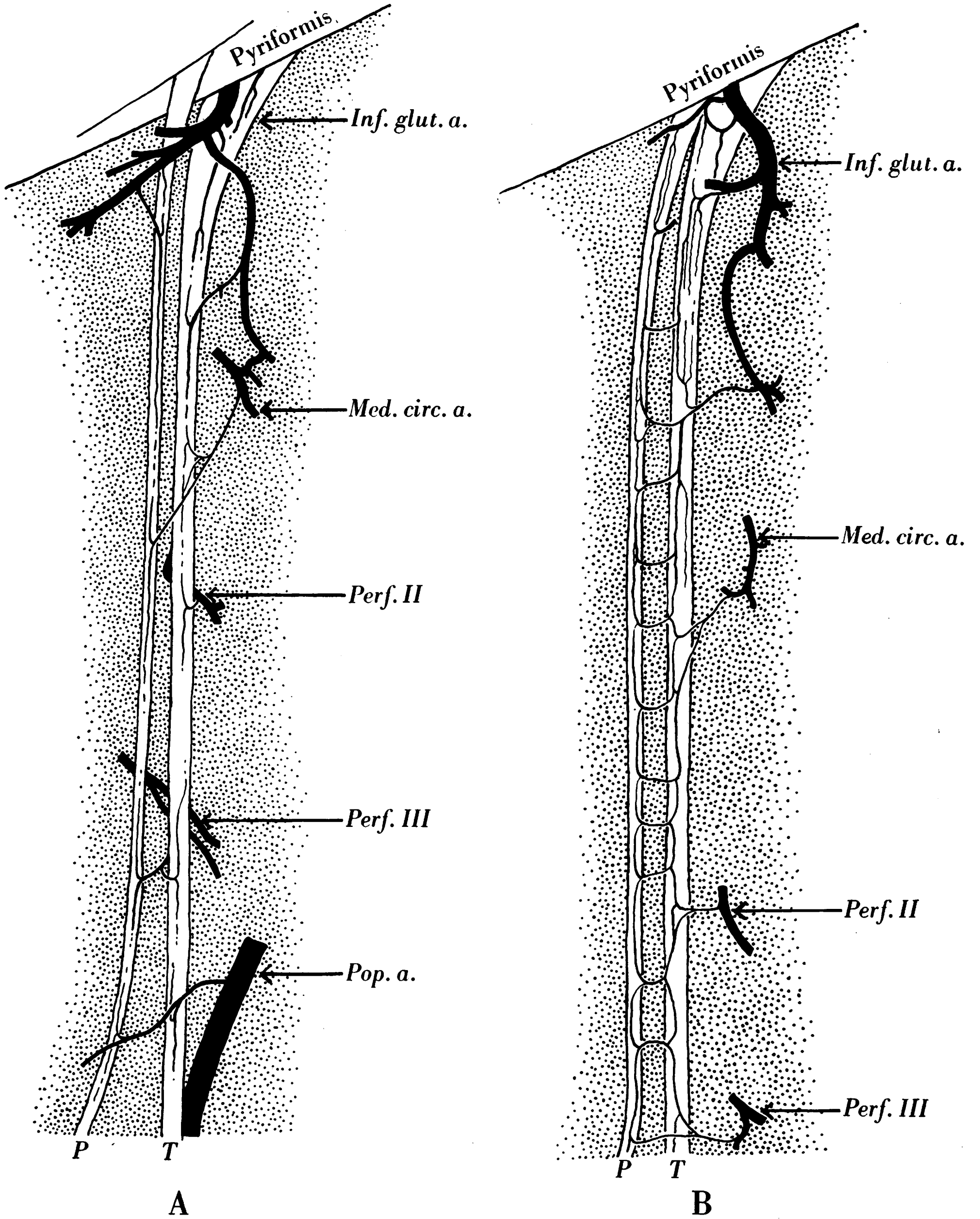
Examination of the nerve after injection with India ink and clearing (Pl. 1, fig. 1) confirms the fact that these nutrient arteries help to form a continuous longitudinally disposed plexus of vessels which lies in the interfascicular connective tissue and is continued upwards into the pelvis. From this primary plexus (Pl. 1, fig. 3) are derived the capillary plexuses of the nerve, which are situated in the endoneural connective tissue. Although every nerve fibre is not in relation with capillaries, nevertheless the plexus is not as sparse as is generally believed. These results agree with those recorded in a variety of mammals by Valentin (1920), who was also able to show that nerve fibres occasionally lie in direct relationship with the capillary plexus.

It must not be assumed from the above that such arterial arrangements obtain universally in the mammals. The vascular connexions of the human sciatic nerve, for example, have been studied by numerous investigators (Tonkow, 1898; Bartholdy, 1897; Hofmann, 1903; Chaumet, Heyman & Mouchet, 1921; Bleicher & Mathieu, 1934; Buitink, 1934; Picco, 1936), whose researches show that some differences in detail exist between the conditions in the rabbit and those in man. The absence normally in man of a small saphenous artery naturally deprives the branches of the sciatic nerve (and therefore the sciatic nerve itself) of those conspicuous vessels which we have seen in the rabbit ascend from this artery along the medial and lateral popliteal and sural nerves. According to the excellent description given by Hofmann, this defect is compensated for by an increase in the number of nutrient arteries which the two divisions of the sciatic nerve receive in the thigh—for the perforating arteries as well as the medial femoral circumflex and inferior gluteal all appear to send tered in the human sciatic nerve, in which the lateral popliteal division derives its blood almost entirely by way of the longitudinal vascular pathway within the medial popliteal nerve, through



Text-fig. 1. Left thigh of the rabbit showing the sciatic nerve as exposed at operation in its normal relations. Nutrient arteries are figured both approaching the nerve and upon its surface; no attempt has been made to show their ultimate ramifications. Nutrient veins have been removed. The following abbreviations are used for this and the next figures: *Inf. glut. a.* = inferior gluteal artery; *Pop. a.* = popliteal artery; *Pop. v.* = popliteal vessels; *Med. circ. a.* = medial femoral circumflex artery; *Sm. saph. a.* = small saphenous artery; *Prof. br.* = nutrient branch of profunda femoris artery; *Perf. II, III* = perforating branches of profunda femoris artery; *Med.* (*Lat.*) *pop. n.* = medial (lateral) popliteal nerve.

nutrient vessels to the sciatic nerve. Thus the medial popliteal nerve may receive eight successive nutrient arteries and the lateral popliteal four (Text-fig. 2A). Frequently, however, a further variation is encountered in the human sciatic nerve, in which the lateral popliteal division derives its blood almost entirely by way of the longitudinal vascular pathway within the medial popliteal nerve, through numerous arcuate vessels passing from the one to the other (Text-fig. 2B). Hofmann attributes to this reduced blood supply the well-known greater vulnerability of the lateral popliteal division of the sciatic nerve, particularly where it has been subjected to stretching; although an important factor may also be the more slender longitudinal pathway in this nerve, since he considered that this would be much more liable to occlusion in elongation of the nerve than the more robust anastomotic plexus of the medial popliteal division. His conception of the vascular independence and individuality of the two main divisions of the sciatic nerve is a most interesting one, and it may have far-reaching implications.



Text-fig. 2. The vascular connexions of the human sciatic nerve in the thigh (after Hofmann). The figures show the two principal types of vascularization: A, in which the medial (*T*) and lateral (*P*) popliteal nerves receive their nutrient vessels independently; and B, in which the vascular supply of the lateral popliteal nerve is derived from that of the medial. Other abbreviations as for Text-fig. 1.

In my experiments twenty rabbits were investigated. Anaesthesia was induced by intravenous nembutal prolonged when necessary by the administration of ether. The approach to the sciatic nerve was by the conventional (lateral) route: after incision of the skin the femoro-coccygeus and biceps muscles were reflected from their attachments anteriorly, along a curved line commencing at the coccyx, extending outwards to the great trochanter, thence downwards on the outer side of the thigh, past the patella to the outer aspect of the leg. In this way only the aponeurotic attachments of these muscles are severed. The muscles were then retracted backwards after ligation of the branches of the small saphenous vessels which supply them. The gluteus maximus was then detached from its insertion into the third trochanter, and its posterior moiety separated and reflected upwards. Reflexion then of the gluteus medius muscle from the great trochanter resulted in an almost complete exposure of the sciatic nerve in the thigh (Text-fig. 1). Ligation of the inferior gluteal artery was however considerably facilitated by the reflexion of the pyriformis muscle also.

The nerve having been thus exposed, one of the following procedures was then carried out:

(1) *Ligation of the inferior gluteal artery alone.* Where it enters the thigh this artery is intimately related to the sciatic nerve and the nerve to femoro-coccygeus; it is usually under cover of both these nerves and the inferior gluteal vein. Its ligation above its nutrient branches demanded considerable care; in the first place it was difficult at this level to separate it from the vein so that quite often the two had to be ligated together (a difficulty apparently encountered by Okada); secondly, ligation of the artery at this level needed constant vigilance to avoid any interference with the sciatic nerve which partly overlaps it. In certain cases the artery was ligated below as well as above its nutrient vessels to obviate the establishment of a collateral circulation from below.

(2) *Ligation of all sources of supply in the thigh.* The inferior gluteal artery was ligated as described above. The profunda vessels (both arteries and veins because it was impossible to separate them) were then tied off. Finally the distal sources were eliminated by ligation of the small saphenous artery close to its origin from the femoral; in a few cases this vessel was again ligated beyond its nutrient branches to prevent a possible re-establishment of circulation from below.

After operation the animals were left for periods varying from 6 days to 1 month, and were then killed. The nerves were examined histologically by the Marchi method, and by Bodian's technique both alone and in conjunction with Masson's stain. In every case the whole length of the nerve and a considerable part of the medial and lateral popliteal nerves were studied.

OBSERVATIONS

1. *Ligation of the inferior gluteal artery*

In the eight animals in which the inferior gluteal artery was ligated great care was taken to prevent any injury to the nerve; where necessary the artery and the vein were ligated together. In one animal the nerve was purposely freed very carefully from its surroundings for some distance in the region of the inferior gluteal artery. In three cases, in addition to the proximal ligation, the artery was also ligated distally. After operation the animals were left for periods varying from 6 days to 1 month, during which they were frequently examined for any signs of neurological disturbance which might have resulted from the operation.

Results. None of the animals showed any disturbance of movement or of sensation, apart from a slight flexion of the thigh which was frequently observed in the earlier stages and was regarded as a post-operative effect. Reflex movements such as spreading of the toes were unaffected, but it should be pointed out that, according to Young and his collaborators (see Gutman *et al.* 1942), the toe-spreading reflex indicates only the integrity of the lateral popliteal division of the sciatic nerve, a view which has received recent support from the work of Altschul & Turner (1942). Histological examination of the sciatic nerve and of its branches disclosed generally no degeneration whatever or, at the most, degeneration of relatively few solitary fibres (Pl. 2, fig. 4). No connective tissue proliferation or other obvious histological change was observed.

2. *Ligation of all sources of supply*

In twelve animals the inferior gluteal artery, the branch of the profunda femoris artery and the small saphenous artery were all ligated, the first and last of these proximal to the origins of their first nutrient rami. Except in three cases (in which the nerve was also carefully freed from surrounding structures) there was no interference with the nerve. As previously, the animals were left after operation for periods of 6 days to 1 month and they were similarly examined during this period.

Results. In two animals only was any gross abnormality detected. Of the other ten, seven showed no clinical or histological signs whatever of degeneration of the sciatic nerve or of its branches; in the other three, however, none of which had presented any clinical signs of involvement of the nerve, the latter showed a variable but small number of degenerated fibres. In the one of this group (B.C., 14 days) which showed the greatest number of degenerated fibres (Pl. 2, figs. 5, 6), the nerve had, in addition to the ligation, been freed from its surroundings, and the superficial disposition of the degenerated fibres indicates that this interference was possibly responsible.

In the two cases in which clinical signs were clearly observed the ligation had also been accompanied by mobilization of the nerve. Both animals (R. 5, 11 days; B.D., 6 days) showed marked flaccid paralysis of the muscles of the foot and leg, loss of the toe-spread reflex, and analgesia of the foot and lower leg. Histological examination showed, in both cases, that the sciatic nerve and its branches had undergone extensive degeneration (Pl. 2, fig. 7; Pl. 3, figs. 8, 9, 10). If these two cases are compared with the previous one (B.C.) in which mobilization of the nerve was also carried out but in which the degenerative changes were comparatively slight, there seems to be some justification for attributing the much more extensive degeneration here to the effects of the 'devascularization'. Mobilization of a nerve if it is carefully executed, and the nutrient vessels preserved, does not, in my experience, involve many fibres, and has certainly never resulted in the massive changes obtained in these two animals. This view, moreover, is supported by the interesting experiment carried out by Torraca (1920), who, after mobilizing the sciatic nerve in the dog, stripped it of its epineural sheath and surrounded it with a rubber covering. The fact that only a transitory paralysis resulted, and that full power of movement soon returned, indicates clearly that quite extensive interference with the nerve can be carried out without ill effects ensuing. It is interesting to note that Torraca considered the intrinsic (i.e. longitudinal) circulation of an 'isolated' nerve is sufficient to preclude any prospect of serious disturbance to the nerve in such an experiment. In the present experiment the fact remains, however, that degeneration occurred only in the minority of the animals investigated. Is it possible that this may be attributable to variations in the vascularity of the nerve, and that in these two cases the nerve was dependent to a greater degree upon its regional sources of supply? Such a possibility at least demands further investigation.

In one of these two animals (B.D.) the nerve of the opposite leg (right) was sectioned at the time of operation. Examination of the two nerves showed that the effects on the two sides were quite comparable in regard to both the extent and the severity of the degeneration; the clinical signs were also equivalent. A careful study of the 'devascularized' nerve (Pl. 3, fig. 10) and its comparison with the sectioned nerve (Pl. 3, fig. 11) show that the changes in it are just those which might be expected of a sectioned nerve undergoing typical Wallerian degeneration after a corresponding interval of time (6 days), i.e. medullary changes are well advanced, fragmentation of the axis cylinders is generalized, and the proliferation of Schwann cells has just commenced. If then these results are attributable to the 'devascularization', the effects of this procedure must correspond closely to those of typical Wallerian degeneration. Unfortunately it was not possible to determine whether the transition between the normal part of the nerve above, and the degenerated part below, was a sudden or a gradual one.

DISCUSSION

As far as ligation of the inferior gluteal artery alone is concerned it is clear that there is a striking discordance between my results and those of Okada. Whereas he claimed in every case to have produced histological changes in the sciatic nerve, in not one of my series has any significant change resulted from ligation of the inferior gluteal artery alone. My results therefore do not support his contention that occlusion (by ligation) of this source of blood supply materially affects the nerve. Furthermore, in the majority of the animals in which ligation of all sources of supply in the thigh was carried out, the nerve showed either no change at all or none of any significance. In two cases, however, massive degeneration of the nerve did occur; in both of these there had been some additional manipulation although scrupulous care was taken to avoid actual damage to the nervous elements themselves. While I hesitate to attribute solely to trauma the extensive lesions which were observed, nevertheless it cannot be disregarded as a possible causative factor. The possibility of variations in the vascular supply of the nerve must, however, also be considered, for a nerve which is unduly dependent upon its contributory sources of blood supply must surely react more readily to their obliteration than one in which the intrinsic longitudinal pathway can satisfy its normal requirements.

These results therefore justify the assumption that severe disturbance is unlikely to proceed from mobilization of a length of peripheral nerve if this should involve the interruption of only one nutrient vessel; but in the case of more extensive separation of a nerve the effects are rather more uncertain and the results may then depend much more upon variations in blood supply both in the same nerve and as between different nerves. This important aspect of the problem is being pursued.

In discussing this problem, however, we must bear in mind two important considerations:

(1) Manifest degeneration in a nerve signifies a gross disturbance both of structure and of function; it is a change, moreover, which is irreversible. But the absence of degeneration does not necessarily signify that no change at all has occurred within the nerve since there always remains the possibility of *physiological* or reversible changes unassociated with any obvious disorder of the nerve fibres. Evidence from other sources (Lewis, Pickering & Rothschild, 1931) suggests that such physiological changes may occur as a result of ischaemia of nerve and that they may even give rise to objective signs comparable in many ways (but not in their progression) with those resulting from traumatic inter-

ruption of a nerve; in such cases the alterations in the functional capacity of the nerve fibres must apparently fall far short of those necessary to produce actual degeneration since the function both of the nerve and of the parts dependent upon it may be rapidly restored. Nevertheless, it would be interesting to know whether any histological change does occur in the nerve as a result of such temporary ischaemia. In connexion with this the possibility that persistent objective signs may occur in the absence of obvious histological signs of degeneration is mentioned by Aring, Bean, Roseman & Spies (1941), who state that in pellagrins 'mild clinical signs may occur in the face of an apparently normal myelin-sheath content of the nerve', although their evidence for this is not entirely satisfactory.

Relevant also to this discussion is the excruciating pain which is a characteristic symptom of thrombo-angiitis obliterans and which has been attributed to ischaemia of the nerves involved consequent on thrombosis of their vasa nervorum. Meleney & Miller (1925) found that in every case which showed occlusion of the vasa nervorum pain was present, but there were no demonstrable changes in the nerve fibres of the affected nerves. But other workers who likewise attribute the pain to ischaemia of the affected nerve trunks have reported otherwise; Barker (1938), for example, found that occlusion of the vasa nervorum (both arteries and veins) was associated with changes in the nerves which he calls 'Wallerian degeneration'. The lesions, however, do not appear to me to be at all characteristic of typical Wallerian degeneration since (after 2 months or more) 'variations were noted from patchy fragmentation of the myelin to complete loss of myelin and destruction of the entire architecture of the nerve with replacement by fibrous tissue'; while 'the axis cylinders either appeared normal or could not be identified at all' and the presence of Büngner's bands is not mentioned (nor do they appear to be evident in certain of his figures).

There can be little doubt that the difficulty of explaining the symptoms in this and many other allied clinical conditions is due partly to our inadequate knowledge of the physiological results of ischaemia of nerve, and partly to the difficulty of correlating the physiological facts at present at our disposal with what we know of the anatomical characteristics of the blood supply of nerves. The recent researches of Rosenblueth and his collaborators (Rosenblueth & del Poso, 1942) on circulated mammalian nerve suggest that further extensive and careful investigation along such lines would not be unprofitable.

(2) Ligation of such sources as the inferior gluteal or small saphenous arteries does not necessarily deprive a nerve of a continuous supply of blood. The longitudinal vascular pathway which every nerve possesses still retains its continuity through the affected zone, and still presumably remains patent.' Although ligation of a source of supply may produce a temporary local diminution of blood supply it is difficult to conceive how the effect could be other than a transient one, especially in view of the facility with which the longitudinal pathway is capable of enlarging and thus compensating for the local loss. So, unless the longitudinal anastomosis should prove inadequate to accommodate itself to the changed conditions (and this may conceivably be brought about by stretching of the nerve as Hofmann suggests), there is little reason to expect extensive degeneration of the constituent nerve fibres; but the frequency with which the longitudinal pathway may provide a collateral circulation not only to the nerve itself but even to a whole limb (Holl, 1880; Zuckerkandl, 1885; Tonkow, 1898; and others) clearly indicates its potentialities in this respect. Nevertheless, although ligation of a regional source might hardly be expected to have any pronounced or lasting effect upon the nutrition of the nerve it supplies, the conditions must surely be quite different if the occlusion of a nutrient artery is not localized (as it is in the case of a ligature) but involves all its intraneural ramifications (as for example in thrombosis). For then not only would the regional sources be abolished but at the same time the continuity of the longitudinal vascular pathway would be interrupted and the flow of blood through the affected region arrested. An infarction of the nerve thus produced, and the consequent prolonged local ischaemia, might well result in a severe destruction of nervous tissue. Indeed, this is implied in Gammel's explanation (1927, 1928) of the paralyses observed in the condition of Embolia cutis medicamentosa, although in his cases it is quite possibly not the whole story.

While therefore my results suggest very strongly that *remote* interference with the regional sources of blood supply of a nerve has generally no pronounced effect upon the nerve, they do not exclude the possibility of more serious involvement if the occlusion of a nutrient vessel should embrace all its intraneural ramifications, and in this way interrupt the longitudinal vascular pathway in addition. This aspect of the problem is now being investigated.

SUMMARY

1. The blood supply of the sciatic nerve in the thigh of the rabbit is described, and contrasted with that of man.

2. Contrary to Okada's contention that degeneration invariably results from ligation of the inferior gluteal artery, in eight rabbits in which this operation was repeated no degeneration or other obvious histological change occurred.

3. An extension of the experiment to include the other sources of supply of the sciatic nerve in the thigh was carried out in twelve animals. In ten of these there was either no degeneration at all, or if

present it was extremely limited and insignificant. In the other two cases, in both of which the nerve had also been mobilized, extensive degeneration with concomitant clinical signs resulted. It is uncertain however whether these two results are to be attributed to the slight manipulation of the nerve, or to some variation in its intrinsic vascular pattern in these cases.

4. The significance of these results is discussed.

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EXPLANATION OF PLATES

PLATE 1

Fig. 1. Injected and cleared specimen of the lower part of sciatic nerve showing the vascular anastomoses between the nutrient branch (*P.A.*) of the profunda femoris artery and those of the small saphenous artery (marked by arrows), which are running with the medial (*T*) and lateral (*P*) popliteal and sural (*S*) nerves. ×5.

Fig. 2. Transverse section of the lateral popliteal nerve showing the nutrient branch (*Nut.A.*) of the small saphenous artery which ascends along it to the sciatic nerve. Bodian-Masson. ×75.

Fig. 3. Injected and cleared specimen of part of the sciatic nerve showing the interfascicular (precapillary) plexus. Larger epineural vessels are also evident. ×50.

PLATE 2

Fig. 4. Rabbit A.F. (6 days). Ligation of the inferior gluteal artery. Longitudinal section of the medial popliteal division of the sciatic nerve showing solitary degenerated fibres. Not more than 100 degenerated fibres were counted in the entire nerve. Marchi. ×150.

Fig. 5. Rabbit B.C. (14 days). Ligation of all sources. Transverse section of the medial popliteal division of the sciatic nerve in its lower third. The superficial location of the degenerated fibres is evident. A slight haemorrhage is noticeable in the upper part of the section. Marchi. ×60.

Fig. 6. The same. Longitudinal section at a higher level showing the degenerated fibres (*D*) lying superficial to the underlying normal fibres (*N*). Bodian-Masson. ×150.

Fig. 7. Rabbit R. 5 (11 days). Ligation of all sources. Representative longitudinal section of the sciatic nerve showing advanced degeneration of medullary sheaths, which characterizes the entire nerve. Marchi. ×150.

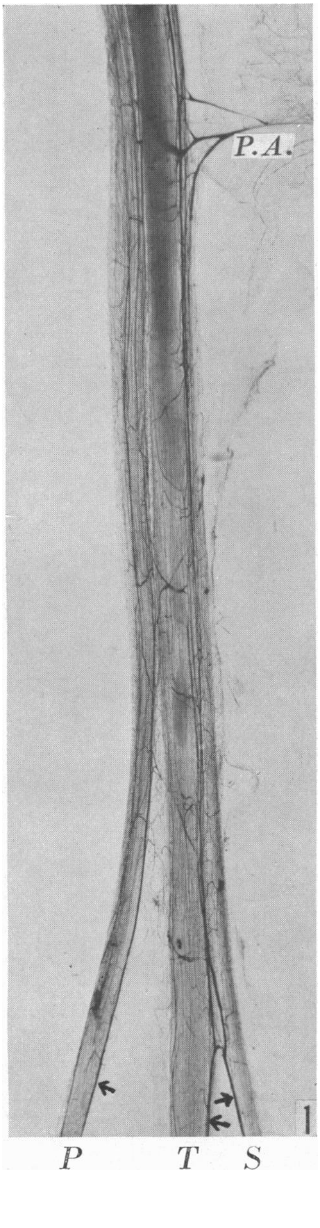
PLATE 3

Fig. 8. Rabbit B.D. (6 days). Left sciatic, ligation of all sources. A representative longitudinal section of the medial popliteal nerve showing extensive destruction of medullary sheaths. Marchi. ×150.

Fig. 9. Rabbit B.D. Left sciatic. Representative longitudinal section of the lateral popliteal nerve also showing extensive medullary changes, but not at such an advanced stage as those seen in the medial popliteal. Marchi. ×150.

Fig. 10. Rabbit B.D. Left sciatic. Representative longitudinal section showing the marked fragmentation of the axis cylinders and formation of 'digestive chambers'. Proliferation of Schwann cells just commencing. Bodian-Masson. ×150.

Fig. 11. Rabbit B.D. (6 days). Right sciatic, sectioned. Longitudinal section of peripheral cut end, showing fragmentation of axis cylinders and commencing proliferation of Schwann cells. For comparison with fig. 10. Bodian-Masson. ×150.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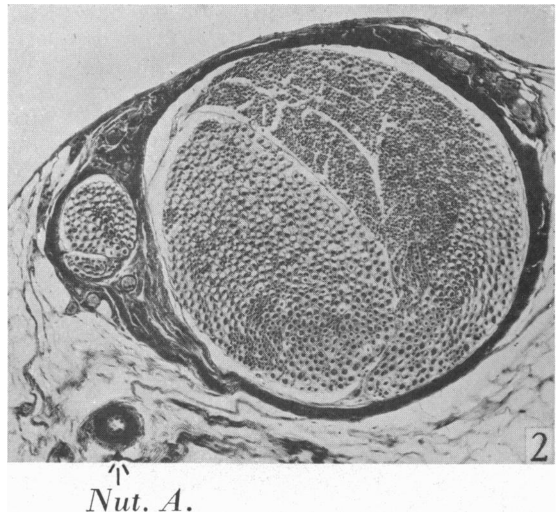
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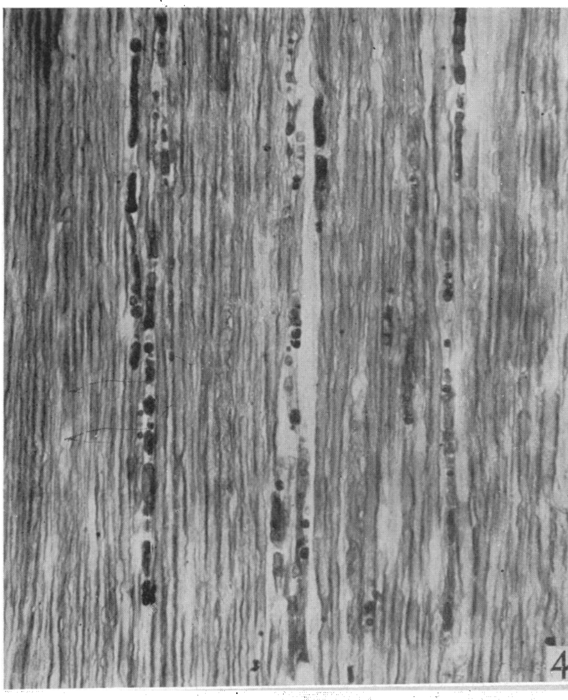
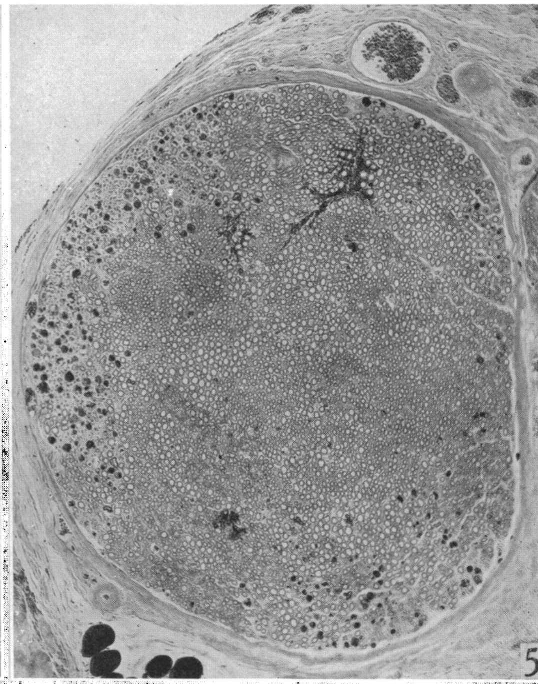
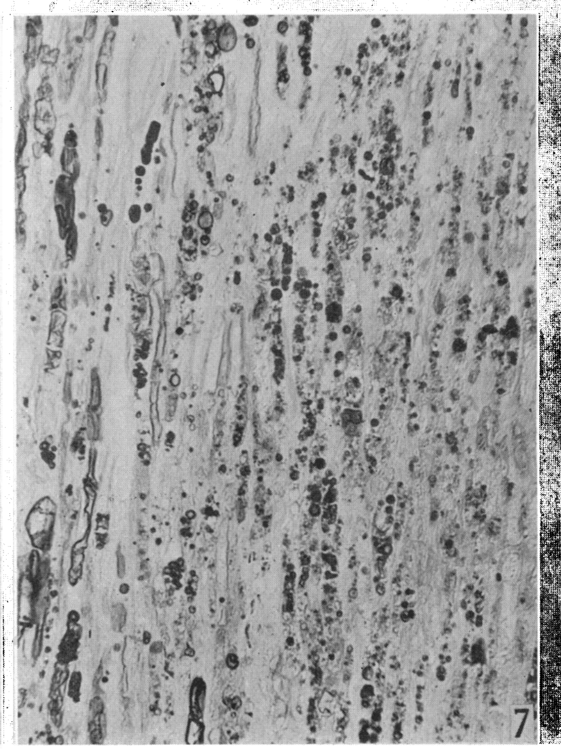
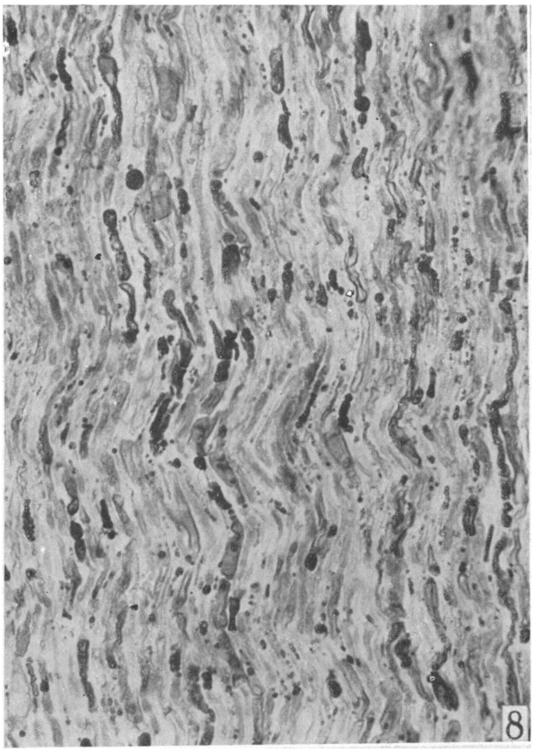
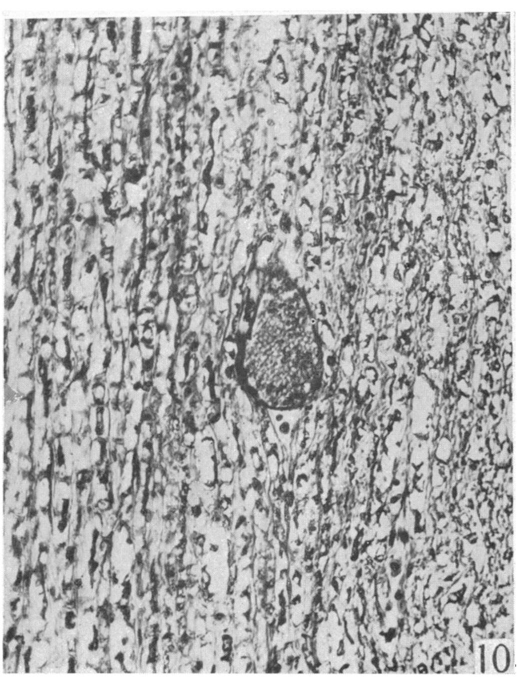


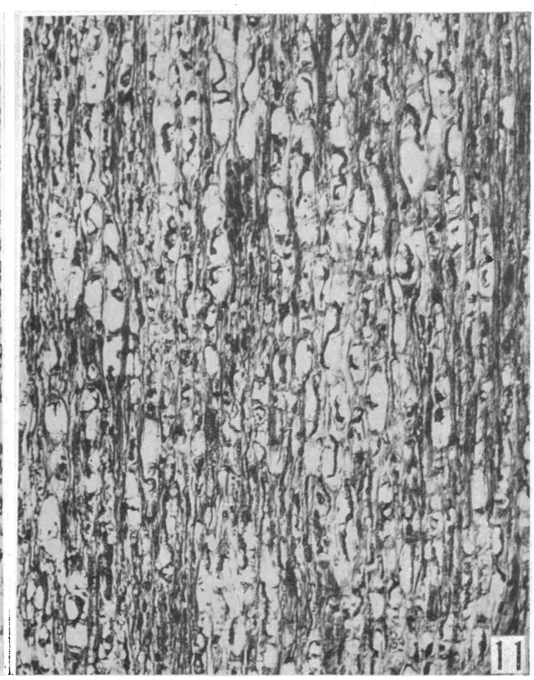




ADAMS—Blood supply of nerves







ADAMS—Blood supply of nerves