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Original Research Article

Role of Sympathetic Denervation in Peripheral Occlusive Arterial Disease - A Critical Appraisal

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Abstract

The role of sympathectomy in improving the muscle blood flow in peripheral occlusive arterial diseases was objectively assessed in 20 limbs of 18 patients.82% of the patients were of Thromboangitis obliterans.2,5 and 13 limbs had claudication alone, rest pain without gangrene, and rest pain with gangrene respectively. Sympathectomy significantly improved the muscle blood flow as determined by arterio-venous differences of PO_2,Glucose and Lactate levels. Clinically, following the operation the 2 Claud cants were cured. In 18 limbs with rest pain,12 had relief of pain to the patient's satisfaction. Out of the 13 with rest pain and gangrene, ulcers healed spontaneously in 8 and the remaining 5 required amputation limited to forefoot only.

Keyword Peripheral ,Vascular, Oclusive, desease, claudication.

Introduction

Ever since the introduction of sympathetic denervation by Adson [1] it remained for a long time the only available surgical treatment to improve the blood flow in a limb in peripheral occlusive arterial diseases. But with the advent of direct arterial surgery, it became somewhat fashionable to disparage this old procedure. The main controversy centred on the question whether sympathectomy improve muscle blood flow or not?

If it improves whether it is nutritive to muscles or by passes it by arterio-venous shunts. The controversy perpetuated mainly because of the lack of correlation between subjective and objective evidence for the improvement of blood flow and inadequately controlled comparison [1,2]. Various practiced methods of evaluation of the blood flow e.g. skin temperature recording, monitoring claudication distance, venous occlusion and digital plethesmography, measurement of ankle arterial pressure, direct measurement of blood flow by electromagnetic flowmeter, indicator dilution technique, isotopic clearance from the muscles, Doppler ultrasonography are perfectly in order Yet none of these are objective enough to evaluated the nutritive state of the muscles. In this paper the results of this state of muscle nutrition both before

and after sympathectomy as studied by using biochemical parameters are presented [2].

Material and Methods

Twenty lumber sympathectomies done on eighteen patients for peripheral occlusive arterial diseases of the lower extremity, admitted to the Medical College Hospital during an eighteen-month period were studied. Fifteen patients were clinically labelled as Thromboangitisobliterans (82%). Majority of the patients on angiographic studies had their lesions predominantly affecting the popliteal artery and downward (Fig. I&II). In all these patients, apart from clinical routine investigations, like Blood for Hb, Total and Differential counts and ESR, Blood urea, Blood sugar, Liver function tests, Serum lipid profile, Chest X-ray, E.C.G., Plain X-ray of Ischaemic limb, the following special investigations were carried out both preoperatively and seven days after: operation.

(i) Arterial and venous glucose levels
(ii) PO2 of arterial and venous blood
(iii) Arterial and venous lactate levels.

The arterial and venous blood samples were drawn from the femoral artery and vein respectively of the affected limb. Besides these, ten patients free from diabetes.

Liver dysfunction, or peripheral occlusive arterial disease were subjected to these tests to serve as control.

The oxygen tension was measured by Astrup'smicrotechnique [3] using BMS 3 MK 2 blood micro system. The glucose estimation was done by Folin Wu technique. The lactate was estimated by enzymatic method after Bergmeyer.

Observations

(A) Clinical

Out of the twenty limbs, 2 had claudication alone, 5 had rest pain without gangrene, and the remaining 13 had rest pain with gangrene, limited to the toes and forefoot only. Both the claudicants had clinically palpable distal pulse (Dorsalispedis and Post. Tibial) while it was absent in all those with rest pain without gangrene and 9 out of 13 with gangrene. 4 of the remaining 13 with rest pain and gangrene had palpable distal pulse though very feeble compared to the less affected side.

(B) Biochemical

The mean ± SD levels of Glucose, oxygen tension and lactate levels in arterial and venous blood with the corresponding A-V differences are shown in Table I for the control and in Table II for the patients. The arterio-venous differences of all the biochemical parameters though fell significantly following sympathectomy but still remained significantly higher than the control (Table III, IV and V). All the

patients were clinically assesed for any subjective improvement after three months of operation. The 2 patients with claudication alone were cured and limb temperature improved (Area that was cold become warm). Of the 18 limbs with rest pain, pain was relieved to the extent not to interfere with daily pursuits in 12, diminished but still

interfering with daily routine in 5 and worsened in one patient. These later 6 patients did not feel satisfied with the operation. Out of the 13 patients with rest pain and ischaemic necrosis only 5 patients required minor amputation limited to forefoot only, while in the remaining 8 patients, ulcers healed spontaneously.

Table 1: Showing the mean ± SD levels of glucose, oxygen tension and lactate levels arterial and venous blood with the corresponding A-V differences in the control(10 patients).

	Arterial	Venous	A-V
Glucose (mg%)	87 .70±9.78	86.10±9.93	1.60±0.84
PO_2 (mmHg)	81.45±4.53	66.96±4.06	14.49±2.96
Lactate (mMoles/L)	0.79±0.05	0.99±0.19	0.19±0.05

Table 2: Showing the mean ± SD levels of glucose oxygen tension and lactase levels and corresponding A-V differences in patients both before and after sympathectomy.

	ARTERIAL		VENOUS		A-V	
	Pre-operative	Post-operative	Pre-operative	Post-operative	Pre-operative	Post-operative
Glucose (mg %)	105.30±9.39	103.50±9.69	86.9±9.60	93.25±8.62	18.40±4.95	10.25±3.96
PO_2 (mmHg)	81.67±4.08	81.04±3.28	36.96±3.56	61.84±5.07	44.02±5.70	19.19±3.5
Lactate* (mMoles/L)	0.79±0.12	0.35±0.10	2.13±0.78	1.60±0.43	1.36 ±0.66	0.75±0.4

*Done in 14 patients.

Table 3: Statistical analysis of the A-V difference of glucose levels before and after sympathectomy.

		Vs. control (LO)	Preop. Vs. Postoperative
Pre-operative (20)	18.40±4.95	t =10.2954 p < 0.001	
Post-operative (20)	10.35±3.94	t = 6.6419 p < 0.001	t =11.4084 p < 0.001

Control value 1.60 ± 0.84

Table 4: Showing the statistical analysis of PO2 differences both before and after sympathectomy against the control

		Control Vs (LO)	Pre: Post-operative
Pre-operative (20)	44.02±3.94	t =14.8513 p < 0.001	
Post-Operative (20)	19.19±3.57	t = 3.5250 p < 0.01	t =23.9158 p < 0.001

Control value 14.49±2.95

Table 5: Showing the statistical analysis of the arterio-venous lactate level differences before and after sympathectomy against the control

		Control (10) Vs	Pre-operative vsPost-operative
Pre-operative (14)	1.37±0.67	t =4.5139 p < 0.001	
Post-Operative (14)	0.75±0.41	t = 2.1767 p < 0.05	t =6.7777 p < 0.001

Control value 0.19±0.05

Discussion

In recent years with the advent of direct arterial surgery for peripheral occlusive arterial diseases, sympathetic denervation had been loosing its ground. The protagonist of direct arterial surgery argue that sympathectomy fails to relieve claudication [3]. This may be true in severe. cases, yet it is a common experience that a variable number of patients do get relieve from claudication after sympathectomy.:

Figure 1: Angiography of intra-arterial lesions in popliteal artery running distally

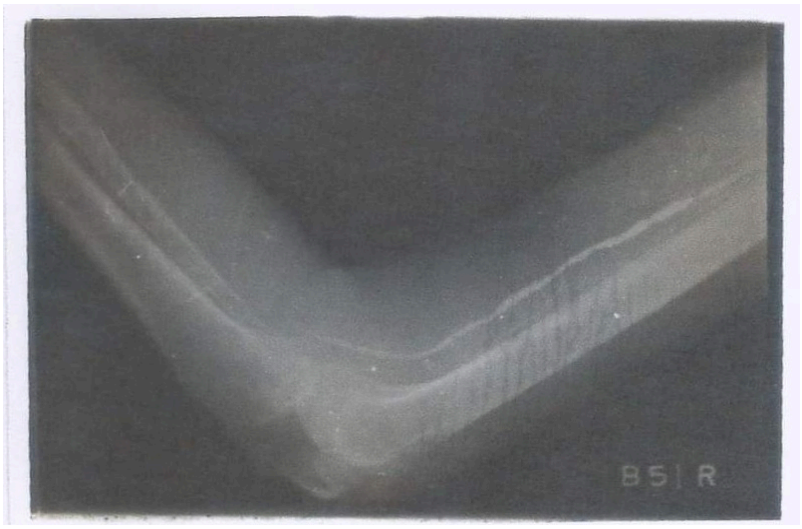

Figure 2: Angiography of occlusive lesions in popliteal artery

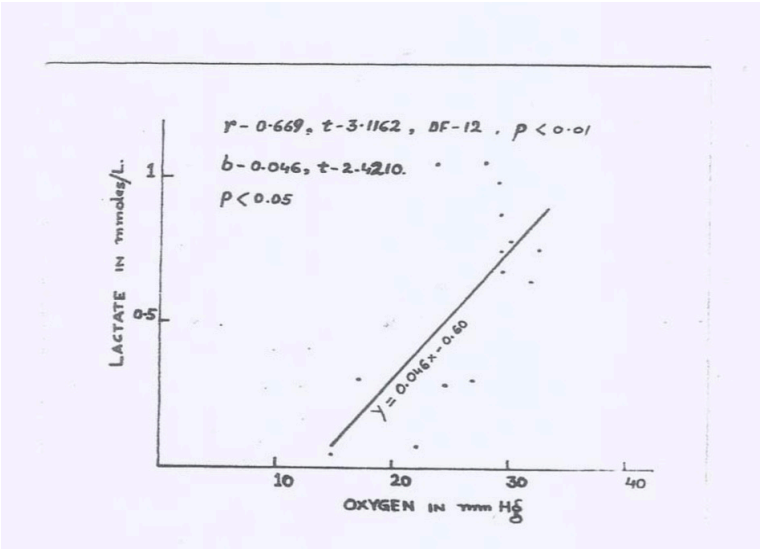

Figure 3: Presence of linear regression analysis between oxygen and lactate

Direct arterial surgery has its own limitations. Apart from necessary expertise this is only feasible in an artery of some calibre (Large & medium) where the main arterial [3,4].

trunk is relatively free but if the disease is primarily affecting the smaller vessels, sympathetic denervation remains the only available surgical means for the limb salvage. In the past, a lack of precise knowledge about the function of the sympathetic nervous system vis-à-vis the muscle vessels was mainly responsible for the growing

pessimism towards sympathectomy. It is now well established that two types of receptors are evident in the muscles (alpha and beta). Adrenaline acts on the beta receptors leading to vasodilation while nor-adrenaline on the alpha receptors leading to vasoconstriction, the later outnumbering the former [4]; further the vasoconstrictor supply is tonically active while the dilator supply is not. Thus there is no reason as to why the blood supply to the muscles should not improve following sympathetic denervation, provided the muscle blood vessels too are not occluded in a generalised fashion from the disease [5,6].

In the west, most of the peripheral occlusive arterial diseases are arteriosclerotic in nature leading to thrombo-embolism, aneurysm formation and often dissection [4]. In this country the disease is far less common than thromboangitisobliterans, the later accounting from 48-63% [10, 12] as against 1% in the West. In the present study fifteen of the eighteen patients were of thromboangitisobliterans accounting for 82% of the total patients where the disease had been so peripheral as to limit the scope for direct arterial surgery. It can further be argued in favour of sympathectomy in such situations that it is primarily intended to save the limb from gangrene (if not occured already) or to avoid major amputation in the presence of established gangrene [6,7]. Many patients following sympathectony having no significant relief from calaudication can still carry on by tailoring there activity. Nevertheless in extreme cases, failure of sympathectony still leaves the option open for direct arterial surgery but when sympathectomy failed afterwards direct surgery is seldom rewarding [7]. It, therefore, demands a more objective assessment of the results of sympathectony per se rather than to make an attempt to compare it with direct arterial surgery. Ischaemic limb tissues metabolise glucose and since the blood supply is less than normal the extraction of glucose is more complete as to make A-V difference to exceed that of the control [8]. Sympathectomy had reduced the A-V difference significantly by nearly 50% though not quite to the control level. Since glucose is utilised exclusively by muscles in anerobic conditions (in aerobic conditions muscle prefer free fatty acids) in 13 the fall in the A-V difference of glucose levels following sympathectomy can reasonably be ascribed to an increased muscle blood flow which spares muscles to utilise glucose; the same trend was observed too with regard to PO_2. In an ischaemic limb the oxygen extraction is more complete to cause a wider A-V difference. A fall in this A-V difference following sympathetic denervation is therefore a reflection of increased blood flow. lactic acid behaves the same way as glucose and P02. The fall in A-V difference following sympathetic denervation is indicative of fall in anerobic metabolism consequent upon increased blood flow [9].

Controversy still exist as to whether the sympathetic denervation increases the skin or muscle blood flow. The skin flow can be gauged clinically by noting the skin tempera-

ture. Muscles constitutes 80% of the metabolically active tissue of the limb. So it will be logical that muscles are the main contributors to the altered blood chemistry in the limb in ischaemic states and following sympathectomy. Thus, the identical pattern of changes in the arteriovenous differences of glucose, oxygen tension and lactate level

indicate that any improvement in blood flow is also shared by the muscles in a good measure [10].Although all the three parameters behave the same way yet only a significant correlation with a linear regression is evident between oxygen and lactic acid (Fig. III). [13] The absence of correlation between glucose to PO2 and lactic acid is explicable by the fact that even in anerobic state glucose do not wholly go into anerobic cycle as a variable amount still follow aerobic Kreb's Cycle [11,12].

Thus sympathectomy produce significant improvement in the blood flow to a limb (both muscles and skin) regardless of the extent of the disease. This is also true but bythe post-operative clinical appraisal as stated earlier. [14]

Conclusion

This research paper has discussed the importance of sympathectomy can enhance the tissue blood flow in peripheral occlusive arterial illness and be objectively evaluated in 20 limbs of 18 people,2 with only claudication,5 with rest pain without gangrene and 13 with rest pain and gangrene. 80% of patients discussed above were having thromboangitisobliterans. On the other hand, this research paper discovered that sympathectomy can significantly enhance the muscle plasma flow as determined by arterio-venous changes of “Po2”, “Glucose” and “Lactate levels”.

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