

# The Timing of Reconstructive Surgery in Relation to the Course of Leprosy\*

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In this discussion of the effects of reconstructive surgery on the state of the disease in leprosy patients the author concludes, from experience with his own cases, that the timing of surgery is important, in that surgical stress can have an activating effect on the leprosy, and conversely that activity of the leprosy may have a deleterious effect on the surgical results.

## INTRODUCTION

Some years ago I was puzzled when a patient with seemingly quiescent dimorphous leprosy developed a papular rash after undergoing a tibialis posterior transfer operation for foot-drop. The eruptions did not respond to anti-histaminics, or to topical applications. When smears were taken from the lesions, *Mycobacterium leprae* were found in large numbers and the bacteriological index (BI) was over +3. This and similar events turned my attention to the effect which surgery might have on the morbid status of the disease. Conversely, the question arose whether the morbid status of the disease might influence the results of surgery. If either of these effects could be demonstrated, then the timing of surgery in the course of leprosy would become more important than has hitherto been allowed for.

In the literature on reconstructive surgery in leprosy this problem is either not mentioned at all, or dealt with only in passing, and then in somewhat vague, general terms. The Report of the Panel on Physical Rehabilitation of the Eighth International Leprosy Congress (1963) makes no mention of the timing of surgery. (This paper was written before the Ninth International Leprosy Congress.) Andersen (1963) recommends that the BI should have come down to +1 or lower before surgery is

undertaken. Lennox (1965) writes that in foot-drop the pattern of paralysis should have become stable and remained so for 6 months before surgical correction. This may or may not imply an inactive state of the disease, but he does not expressly say so. According to Antia (1964) the correction of facial deformities should be deferred until the disease is quiescent. Brand (1964*a*) states: "Rebuilding of the face should be delayed until the leprosy is completely under control and skin tests no longer reveal bacilli, otherwise good surgical results may be spoilt by further damage. Hands and feet, however, may often be repaired earlier in the disease, so long as the local tissues do not show any infiltration. This is because damage in the limbs is due mainly to nerve paralysis and is to be corrected by the transfer of muscles which do not become paralysed even if the leprosy continues to advance. The tissues of leprosy patients heal well if ordinary aseptic surgical techniques are used." He reiterates the second point when he says (Brand, 1964*b*): "The presence of the disease itself need not contraindicate operations on the hand, but if there is . . . any sign of local or general hyperactivity of the disease, surgery should be postponed."

From the foregoing, the following conclusions may be drawn: (1) in facial deformities reconstruction should wait till the disease is quiescent; (2) in surgery of the extremities not much importance is attached to the state of the disease. If this is considered at all, it is only with

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a view to the influence which active disease may have on surgical results; the possible effect of surgery on the course of the leprosy is not taken into account. I therefore started studying the problem from both aspects, namely, the effect of surgery on the morbid status of leprosy, and of the morbid status of leprosy on surgical results.

## EFFECT OF SURGERY ON LEPROSY

### *Materials and methods*

If surgical stress has an effect on the state of activity of the disease one would expect signs of increased activity after the operation when compared with the activity of the disease before operation. As indicators of activity we used the bacteriological index (BI) and clinical signs, such as exacerbation and dissemination of skin lesions, neuritis, iritis, erythema nodosum leprosum (ENL) and lepra reaction. In bacilliferous leprosy the BI was found to be the best and most readily comparable criterion, and was used as the main indicator of activity, supported by signs of clinical activity. In non-bacilliferous cases we relied mainly on clinical signs of activity, in addition to routine bacteriological examination.

Further, it appeared important to distinguish between the different types of leprosy, and also between active and inactive states of the disease. Preliminary evaluations showed that the age and sex of the patient had no influence on the outcome of the study, therefore no attention was paid to these factors. Patients with complications such as secondary infection or intercurrent disease were excluded, as these complications are known to be potential causes of exacerbation. All major surgical procedures, mainly reconstructive, but also other operations, were included in this study. Patients with bacilliferous leprosy were classified into lepromatous and dimorphous, and subdivided into 3 groups: (1) *Arrested*, that is, BI negative and no clinical signs of activity for 12 months or more. (2) *Quiescent*, same criteria as (1), but of less than 12 months' duration. (3) *Active*, BI positive and/or clinical signs of activity.

Non-bacilliferous cases were classified into tuberculoid and indeterminate leprosy (there were no polyneuritic cases) and subdivided into 2 groups: (1) *inactive* patients who showed no signs of clinical activity; and (2) those with *active* lesions.

All patients who came up for operation and could be categorized as described above without any doubt were included in this study. They came from 2 hospitals and over various periods, namely from Purulia Leprosy Hospital between 1963 and 1965, and from Chevayur Leprosy Sanatorium in the period 1962-65. Before operation they were given a complete clinical check-up, including history of their leprosy, and skin smears were taken according to the "slit-and-scrape" method and read on the 0-6 scale of Ridley. The same procedure was repeated 2 and 4 weeks after operation, in some cases also later. Cases were included only if all the necessary data were available. The numbers, classification, and subdivision of patients studied are shown in Table 1.

TABLE 1  
Distribution of the various types of leprosy

<i>Classification</i>	<i>Arrested</i>	<i>Quiescent</i>	<i>Active</i>	<i>Total</i>
Lepromatous	7	14	31	52
Dimorphous	4	6	9	19
		<i>Inactive</i>	<i>Active</i>	
Tuberculoid		21	6	27
Indeterminate		12	1	13
Total	11	53	47	111

### *Results*

The results are shown in Tables 2 and 3. As several patients underwent more than one operation, the total number of operations (146) is higher than the number of patients (111). Among the patients who were affected by surgery some showed only a rise in the BI, some showed signs of increased clinical activity in addition, and some showed signs of increased clinical activity only. Therefore the total of affected cases is less than the total of the 2 former categories.

(1) *Lepromatous and dimorphous leprosy.*  
 (a) *Arrested:* In the great majority of this group no reactivation was found. There was, however, one lepromatous patient who had been bacteriologically negative for more than one year (tested on 5 occasions) and whose BI rose to +0.25 again after one operation.  
 (b) *Quiescent:* In this group also the disease in the majority of patients remained inactive after surgery, but 4 patients became bacteriologically positive postoperatively after being negative for various periods. One lepromatous patient had been negative for nearly one year, but his BI became +0.875 and he developed temporary paralysis of the flexor longus sublimis muscle after a series of 5 operations.

TABLE 2  
 Number of operations with effects of surgery on activity of leprosy (lepromatous and dimorphous)

Group	Arrested	Quiescent	Active	Total
<i>Lepromatous</i>				
No. of operations	10	18	35	63
Affected: BI	1	2	13	16
clinically	0	2	6	8
total	1	2	19	22
Unaffected	9	16	16	41
% Affected	10%	11%	54%	
<i>Dimorphous</i>				
No. of operations	5	7	10	22
Affected: BI	0	2	4	6
clinically	0	1	3	4
total	0	2	5	7
Unaffected	5	5	5	15
% Unaffected	0%	31%	50%	

(c) *Active:* Of the patients subjected to 35 operations in the lepromatous group 19 showed a rise in the BI or an increase of clinical activity after operation. In the most spectacular case the BI, which was +1 before operation, rose after a series of 3 operations to +4 and then to +4.125, without any signs of acute reaction. Six patients had reactions and/or ENL; none of these episodes was accompanied by a rise in the BI. Other patients showed no rise in the BI at all and many continued to improve, as in the following case in which the BI fell from +1.5 to +0.88 with DDS treatment and after

operation improved still further to +0.5 and +0.375. It should be mentioned here that most patients continued specific treatment during surgery, except when reactions developed. The percentage of affected cases is about equal in lepromatous and dimorphous leprosy.

(2) *Tuberculoid and indeterminate leprosy.*  
 (a) *Inactive:* In none of these cases was any sign of reactivation seen. (b) *Active:* Only 10 operations were performed on patients in this category. Of these, one tuberculoid patient showed temporary paresis of the wrist extensors of the operated hand after operation. One patient with indeterminate disease who had mild signs of activity before surgery showed exacerbation, with erythema in old lesions and a number of fresh macular lesions one month after a series of three operations. His BI remained negative throughout. None of these cases became bacteriologically positive.

TABLE 3  
 Number of operations with effects of surgery on activity of leprosy (tuberculoid and indeterminate)

Group	Inactive	Active	Total
<i>Tuberculoid</i>			
No. of operations	34	7	41
Affected	0	1	1
Unaffected	34	6	40
% Affected	0%	14%	
<i>Indeterminate</i>			
No. of operations	17	3	20
Affected	0	1	1
Unaffected	17	2	19
% Affected	0%	33%	

(3) *The rise in the BI.* This varied a great deal; in some cases it increased only from +0.12 to +0.25, but in others from +1 to +3 or more. The average deterioration is shown in Table 4, separately for lepromatous and dimorphous leprosy, and separately for all cases with a positive pre- and/or postoperative BI, and all deteriorated cases only.

The increase of the BI in absolute figures and as a percentage of the preoperative level is much more marked in dimorphous than in lepromatous leprosy.

TABLE 4  
Average increases in the BI in lepromatous and dimorphous leprosy, after surgery

<i>All cases with positive BI</i>	<i>Lepromatous</i>	<i>Dimorphous</i>
Pre-op. average BI	41.00 : 38=1.08	6.97 : 12=0.58
Post-op. average BI	42.02 : 38=1.10	10.59 : 12=0.88
Difference in %	0.02 1.85%	0.30 51.70%
<i>Deteriorated cases only</i>		
Pre-op. average BI	14.94 : 16=0.93	3.75 : 6=0.63
Post-op. average BI	23.90 : 16=1.50	8.87 : 6=1.48
Difference in %	0.57 61%	0.85 135%

(4) *Clinical activity.* Table 5 shows the number and percentage of cases in which clinical activity increased after surgery. All these cases occurred in the active or quiescent stages of the disease, none in the arrested stage.

TABLE 5  
Number and percentage of cases showing increased clinical activity

<i>Group</i>	<i>Inactive Nos. (%)</i>		<i>Active Nos. (%)</i>		<i>Total</i>
Lepromatous	2	12	6	17	8
Dimorphous	1	11	3	30	4
Tuberculoid	0	0	1	17	1
Indeterminate	0	0	1	33	1

Among the 14 cases the highest percentage occurred in dimorphous leprosy. The degree of activation ranged from mild to severe. There were 3 lepra reactions, 2 of them being associated with a rise of BI, and 3 reactions with ENL but no rise of BI. Three times ENL appeared or increased after operation, without a rise of BI. Three cases showed dissemination of lesions, in 2 accompanied by an increase of BI. In 2 cases, one lepromatous and one tuberculoid, there was temporary motor nerve damage in the operated arm. It is noteworthy that out of 14 mani-

festations of increased clinical activity only 6 were associated with a rise in the BI.

The 2 cases of motor nerve damage merit closer scrutiny. Both occurred in patients with active leprosy and after multiple operations, and both had been operated on with a tourniquet on the arm on which the damage occurred. One cannot be sure whether the nerve damage was due to surgical stress or to the pressure of the tourniquet on a still actively diseased nerve. In any case it seems advisable to operate on patients with active disease without a tourniquet and on the elevated hand operation table, or in the case of the lower extremities in Trendelenburg's position. This causes little inconvenience to the surgeon and reduces the danger to sensitive nerves, saves anaesthetics, and minimizes surgical stress.

(5) *Multiple operations.* It was interesting to observe the effect of more than one operation. Operations which followed a previous one within 2 months or less were considered as multiple operations. A typical case is the following: A lepromatous patient with a BI of +2.62 underwent a temporalis transfer on the right eye. After the operation the BI came down to +2.25; 5 weeks later he had a tarsorrhaphy to the left eye, and 2 weeks after that the BI rose to +3.00. The second operation, though small, had a definite cumulative effect, adding to the stress of the first. An evaluation of all multiple operations is shown in Tables 6 and 7.

TABLE 6  
Showing effect of multiple operations on activity of leprosy, with number of cases affected

<i>Type</i>	<i>Group</i>	<i>Arrested</i>	<i>Quiescent</i>	<i>Active</i>	<i>Total</i>
Lepromatous	No. of operations	2	3	7	12
	Affected	0	2	5	7
Dimorphous	No. of operations	1	2	0	3
	Affected	0	1	0	1
Tuberculoid	No. of operations	9		1	10
	Affected	0		1	1
Indeterminate	No. of operations	4		1	5
	Affected	0		1	1

TABLE 7  
Average deterioration of BI after multiple operations in patients with active lepromatous leprosy

	All cases	Deteriorated cases only
Pre-op. average BI	9.965 : 7 = 1.42	5.84 : 4 = 1.47
Post-op. average BI	13.435 : 7 = 1.92	10.62 : 4 = 2.66
Difference	0.50	1.19
% difference	35%	81%

Although the numbers are small it would appear that the percentage of affected cases and the degree of deterioration of the BI is considerably higher than in single operations.

(6) *Comparison between different types of leprosy.* The percentage of affected cases is markedly higher in bacilliferous leprosy than in non-bacilliferous leprosy. There is hardly any difference between lepromatous and dimorphous leprosy in this respect, but dimorphous leprosy shows a decidedly higher average deterioration of the BI, and also a higher percentage of clinical signs of increased activity, than does lepromatous leprosy. The figures regarding the effect of multiple operations are too small for comparison. The impression that dimorphous leprosy is more sensitive to surgical stress is not surprising, but confirms the well-known fact that dimorphous leprosy is more unstable than lepromatous leprosy. The number of operations on patients with active tuberculoid and indeterminate leprosy is too small to allow of any firm conclusions, but it would seem that non-bacilliferous leprosy is more stable than both lepromatous and dimorphous leprosy.

(7) *Metaplastic bone formation.* This is an effect of surgery which needs separate consideration. Because of the uncertainty of its pathogenesis I did not include this phenomenon with the other signs of increased clinical activity. It occurs occasionally at the proximal phalanx of operated fingers in the scar of the insertion of the tendon graft, and often in more than one finger of the same hand. In the present study it occurred in 7 cases, 2 in active lepromatous, 2 in

active dimorphous, and 3 in active tuberculoid leprosy. Clinically it appears as a hard, bony, immobile lump, closely resembling an exostosis, and starting 7 to 10 weeks after operation. It may recede later or may persist for years. It may also seriously interfere with the functioning of the graft. X-ray examination shows more or less massive bone apposition to the phalanx in this area. Histologically it consists of proliferating fibroblasts, proliferating cartilage, and osteoid tissue consistent with a hypertrophic scar undergoing metaplastic changes.

The pathogenesis of this phenomenon is not at all clear. It has been suggested that it is something like myositis ossificans which would involve trauma to the periosteum. But this cannot be the only reason, if indeed it plays any role at all. Often in a particular patient more than one finger may be affected, whereas many other patients undergoing similar operations show no such reaction at all; one does not cut or scratch the periosteum in several fingers in one patient and not at all in many others. Some other factor must be involved. Reviewing our patients we found that at the time of operation all of them showed signs of active disease, more especially disease in the healing phase. Histologically, there is no specific granulation tissue in these lumps. It could be a "specific alteration of tissue reactivity" associated in some way with an hyperergic response to a paucibacillary infection (Browne, 1965). Whatever it is, it may seriously interfere with the results of surgery.

## RESULTS OF SURGERY IN DIFFERENT STATES OF LEPROSY

This part of the study was carried out in order to determine whether the morbid status of the disease at the time of operation has any influence on the results of surgery.

### *Materials and methods*

To a large extent the same patients as for the first part of the study were included in the second part, making sure that there were no postoperative complications other than increased

TABLE 8  
Sample studied

Group	Inactive	Active	Total
Short term	22	38	60
Long term	12	29	41
Total	34	67	101

activity. Only patients who underwent reconstructive surgery were included, as we were concerned with the results of this procedure. The patients were divided into active and inactive cases, the latter group including the quiescent and arrested state of bacilliferous leprosy. The results of the operation were assessed 3 months and 12 months after operation, and here referred to as short-term and long-term results respectively. The assessment was made in most cases by the same experienced assessor and independently of the surgeon, and 5 categories were designated, namely excellent, good, fairly good, fair, and poor. Not all the patients were available for long-term assessment and therefore the number of short-term assessments is larger than of long-term ones. The total number of operations assessed was 60, all of which received a short-term assessment, while the number of long-term assessments was 41; 34 were done on patients with inactive leprosy, and 67 on patients with active leprosy. The distribution of the sample studied is shown in Table 8.

The results of the assessments are shown in Table 9, with the number of operations and

TABLE 9  
Results of surgery in active and inactive states of leprosy

Result	Short-term				Long-term			
	Inactive		Active		Inactive		Active	
	Nos.	(%)	Nos.	(%)	Nos.	(%)	Nos.	(%)
Excellent	2	(9)	3	(8)	2	(17)	2	(7)
Good	13	(59)	15	(39)	5	(41)	7	(24)
Fairly good	5	(23)	11	(29)	2	(17)	5	(17)
Fair	2	(9)	9	(24)	1	(8)	8	(28)
Poor	—	—	—	—	2	(17)	7	(24)
Total	22	(100)	38	(100)	12	(100)	29	(100)

percentage in each category. There is an unmistakable tendency to less favourable results in operations performed in active leprosy, and somewhat more marked in long-term than in short-term assessments. The numbers are too small to draw more elaborate conclusions, but the tendency is there.

## CONCLUSIONS

The trauma of surgery is a definite stress that may, and in many cases actually does, activate or reactivate the disease process in leprosy. Often the only manifestation is a slight, temporary, rise in the BI, or a mild local or general exacerbation. But in some cases the deterioration is marked, causing a serious setback in the healing of the disease. This is actually not surprising. It is well known that periods of stress such as pregnancy and the puerperium, intercurrent disease, mental strain, even small-pox vaccination, may cause an exacerbation of existing leprosy. As in tuberculosis and other chronic infectious diseases, overstrain and surgery are best avoided in the florid stage of the disease.

Dimorphous leprosy is somewhat more liable to react to surgical stress than is lepromatous leprosy. Tuberculoid leprosy seems to be less sensitive, but because of the small number of operations performed on patients with active tuberculoid leprosy, definite conclusions cannot be drawn on this point.

Several operations in quick succession are a greater stress than one single operation.

In inactive leprosy, reactivation of the disease due to surgical stress is rare, although this possibility should be borne in mind.

Results of surgery may be adversely influenced by an active state of the disease. This seems true not only in facial surgery, in which it is an accepted fact, but also in surgery of the extremities. Again, in view of the relatively small number of observed cases, one has to be careful not to draw definite conclusions too quickly. But further investigation of this relationship seems to be indicated.

In order to avoid unwelcome reactions to

reconstructive (and general) surgery it is advisable to observe the following precautions:

(1) When reconstructive surgery is indicated, a careful assessment of the morbid status with examination of the whole patient, not only the affected limb, should be an important part of the considerations which lead to the determination of the time of operation. This examination includes assessment of the BI, a search for clinical signs of activity, a history of reactions, or of nerve activity, or of eye involvement.

(2) In selective surgery it is best to wait until the disease has become inactive. In bacilliferous leprosy this means 3 months of a negative BI and the absence of clinical activity. In non-bacilliferous leprosy, the absence of clinical activity for the same period.

(3) In emergency operations like tracheotomy, keratitis in lagophthalmos, strangulated hernia, etc., a flare-up of the disease could possibly be avoided or controlled by cautious use of anti-inflammatory agents.

(4) In all cases, surgery should be as gentle as possible, avoiding all unnecessary stress. This includes a sparing use of anaesthetics and judicious use of tourniquets.

#### SUMMARY

(1) A study of the effects of surgery on the course of leprosy, and of the effects of the morbid status of leprosy on the results of surgery is presented.

(2) It is shown that surgical stress has a definite activating or reactivating effect on leprosy.

(3) An active state of the disease has possibly an unfavourable effect on surgical results.

(4) Conclusions are drawn and precautions suggested regarding the timing of reconstructive surgery in relation to the morbid status of the disease.

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