substance—that is, loss of nephrons. In such experiments the remaining nephrons enlarge and take on a volume of work which in the normal kidney they are never called upon to perform. The same, I believe, occurs in human disease, and our concept of renal failure should not be one of disordered function, but rather one of extremely efficient function by a renal remnant now too small for its task. I have tried to describe some of the ruses and tricks which the remaining renal substance employs to carry on its work so as to maintain excretory function and to preserve as long as possible the composition of the *milieu intérieur* with regard to sodium, potassium, water, and other substances essential to survival.

I have pleasure in acknowledging the great debt I owe to members of my team in Manchester and formerly in Sheffield for their help, discussion, and criticism. I have referred to them previously as my fellow nephro-philis, and the term is not entirely facetious, for I would like my envoy to be a salutation to the kidney itself—*viscus elegantissimum*, as Jean Oliver, quoting from the older anatomists, has recently called it. For the kidney has contributed much interest to my life and thought for many years; I would like to express my admiration of its structure and for the quiet and efficient way in which it handles its problems; and although we are still too ignorant to do much to remedy its disorders, these, I feel, are not the fault of the kidney itself, which seems to devise every possible adaptation to overcome the handicaps imposed upon it by disease.

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SYMPATHECTOMY FOR RAYNAUD'S DISEASE

RESULTS OF GANGLIONECTOMY AND PRE-GANGLIONIC SECTION COMPARED

BY

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Sympathetic ganglionectomy for Raynaud's disease of the hands produced good results in most cases, but relapse sometimes followed it (Ross, 1935). Telford (1935) and Smithwick (1936) suggested that relapse might be avoided by carrying out a purely pre-ganglionic section of the sympathetic chain. The two operations have never been adequately compared. The present study was planned so that a direct comparison could be made between a group of patients who had had pre-ganglionic section and another earlier group treated by ganglionectomy and reported upon by Ross in 1935. The severity of the disease and the results of operation were assessed by the same methods in each series. The results are compared in Table I.

The patients who had undergone pre-ganglionic section were followed for one to thirteen years after operation. All had been operated upon by members of the surgical professorial unit at St. Bartholomew's Hospital. They had been examined at intervals since operation and again for the purpose of this review,

TABLE I.—Results of Different Operations for Raynaud's Disease Compared

Operation	No of Patients	Results		
		Success*	Improved†	Failure‡
Ganglionectomy (1935 series)	41	29 (71%)	4 (10%)	8 (19%)
Pre-ganglionic section (series to 1951)	39	27 (69%)	5 (13%)	7 (18%)

* Attacks less frequent and less severe. No recurrence of ulceration.

† Ulcers recurred, but pain less and working capacity increased.

‡ No change or worse.

except a few who lived too far away and who replied by letter to a questionnaire. The results of the two operations are very much alike. The two groups are comparable in size and in other respects, except that many of the patients in the second series have been followed for a longer time. It might be that this allowed more failures to become manifest and showed pre-ganglionic section in a less favourable light. To test that possibility the records of the patients who had been followed for more than two years after pre-ganglionic section and finally assessed as failures were examined to see whether there was any evidence to suggest that the results might have been different if they had been assessed at an earlier date. There were five such patients, and in four of them it was quite evident from the case records that the result was a failure before a year had passed after operation. Information was not available about the early progress of the other patient.

Types of Pre-ganglionic Operation Compared

The pre-ganglionic operations were done in one of two ways: (a) Telford's method, in which the sympathetic chain was divided below the third ganglion and turned upwards after the rami communicantes of the second and third ganglion had been cut. (b) A modification of Smithwick's method in which pre-ganglionic section was performed as in (a) but in addition the roots of the second and third thoracic spinal nerves were cut just outside or inside the dura mater.

The results of the two types of operation are shown in Table II. There is little difference between them. This

TABLE II.—Pre-ganglionic Operations Compared

Operation	No. of Limbs	Results		
		Success	Improved	Failure
Telford	43	30 (70%)	7	6
Smithwick	31	22 (68%)	2	7

suggests either that the additional measures taken in the Smithwick technique to prevent regeneration were ineffective or else that relapse was due to some other cause than regeneration.

Factors Influencing the Prognosis after Operation

In Table III are compared the results of ganglionectomy and pre-ganglionic section in three grades of severity of the disease—uncomplicated cases and those complicated by ulceration or scleroderma.

TABLE III.—Analysis According to Severity of Disease

Operation	Severity	No. of Patients	Results		
			Success	Improved	Failure
Ganglionectomy (1935 series)	Uncomplicated	21	21	—	—
	With ulceration	9	7	2	—
	With scleroderma	11	1	2	8
Pre-ganglionic section (1951)	Uncomplicated	22	17	1	4
	With ulceration	10	5	4	1
	With scleroderma	7	5	—	2

The patients with scleroderma treated by pre-ganglionic section (two failures out of seven) did better than those treated by ganglionectomy (eight failures out of eleven), but much significance should not be attached to this, because the numbers are small. Otherwise there is no evidence that the initial severity of the disease influenced the result after operation.

Other factors which might have affected the result after operation were: the age of the patient when the disease started; the duration of the disease before operation; the greater severity judged by involvement of the feet as well as the hands; and the length of the initial period of com-

plete freedom from vasoconstrictive attacks after operation. These factors were studied in the patients who had pre-ganglionic section, but were found to have no effect upon the ultimate results.

Discussion

The most striking finding is the similarity between the results of ganglionectomy and pre-ganglionic section in two comparable groups of patients. It is interesting to see what light this casts on the recurrence of vasomotor attacks after operation. Several theories have been put forward to account for this recurrence after sympathectomy for Raynaud's disease. They include: (1) development of sensitivity of the denervated vessels to circulating adrenaline; (2) regeneration of the divided sympathetic nerves so that continuity is restored; (3) reorganization of alternative nerve pathways; and (4) persistence of a local fault in the digital vessels.

Experimental work has shown that sensitivity to circulating adrenaline is greater after ganglionectomy than after pre-ganglionic section. If adrenaline sensitivity were the explanation of the recurrences after operation the results of pre-ganglionic section would be expected to be better than those of ganglionectomy. It has also been objected to as an explanation on other grounds. Simmons and Sheehan (1937) pointed out that the effects of sensitivity would be expected to appear early, whereas the relapses do not appear for some weeks or months after operation.

Regeneration has been frequently suggested (Simmons and Sheehan, 1937; Smithwick, 1940; White and Smithwick, 1944; Haxton, 1947) as an explanation of relapse. If ganglionectomy has been done it is necessary to postulate the growth of pre-ganglionic cholinergic medullated axons down the degenerated remains of the adrenergic non-medullated post-ganglionic fibres. There is no evidence that this is possible. Kirgis *et al.* (1950) have shown that regeneration does not take place in the cervical sympathetic chain of the cat after ganglionectomy, although it may do so after pre-ganglionic section.

Additional measures taken to prevent regeneration in the pre-ganglionic operations made no difference to the results, as the comparison of the Telford and Smithwick operations showed. If regeneration were the cause of relapses they should not occur at all after ganglionectomy, and they should be seen less often after Smithwick than after Telford operations. As these operations give similar results some other explanation must be sought.

Reorganization of alternative pathways has been suggested (Ray *et al.*, 1943). It is known from anatomical studies that sympathetic fibres and so-called intermediate ganglia exist in the cervical region, where they are outside the scope of surgical removal (Skoog, 1947; Boyd and Monro, 1949). Pathways such as these might in time become the mediators of recurrent nervous vasomotor activity. A more acceptable explanation is that put forward by Lewis (1946). He considered that the disease and its recurrence after sympathectomy were due to continued existence of a "local fault" in the digital vessels.

What regulates the intrinsic tone of the vascular smooth muscle in the absence of vasomotor nerves is unknown. Barcroft and Walker (1949) have shown that it recovers rapidly after sympathectomy even in normal vessels. Until more is known of the fundamental physiology of vascular smooth muscle the nature of the "local fault" in Raynaud's disease cannot be determined.

Finally, it must be decided which operation is best for the patient. Cervico-thoracic ganglionectomy has certain disadvantages, such as the production of Horner's syndrome and nasal congestion. Pre-ganglionic section avoids these and produces equally good effects upon the digital vessels. Smithwick's posterior approach through the third rib is easier and safer for the less experienced operator but sometimes gives persistent post-operative pain in the wound. For the surgeon familiar with the anterior route, Telford's operation is more suitable.

Conclusions

The clinical results of ganglionectomy and of pre-ganglionic sympathetic section for Raynaud's disease are the same.

The absence of unpleasant side-effects from pre-ganglionic section makes it preferable to ganglionectomy.

The similarity in results of the two operations suggests that nerve regeneration is not the chief cause of relapse after sympathectomy.

The possible causes of relapse are discussed. The "local fault" postulated by Lewis is thought to be important.

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SEPTIC JAUNDICE

A COMPLICATION OF PERITONITIS FOLLOWING GASTRO-INTESTINAL SURGERY

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The occurrence of jaundice shortly after operation gives rise to anxiety, and the determination of its cause becomes a matter of importance. That jaundice can be caused by sepsis is known, but reports of this type of case are rare. Brown and Counsellor (1932) described two cases of acute appendicitis in which jaundice was present before operation. An appendix abscess was present in one, and in the other the organ was gangrenous

and purulent. With the subsidence of infection after operation the jaundice cleared rapidly. Philipowicz (1934) reported the development of deep jaundice due to an enormously distended and inflamed caecum and appendix in a 73-year-old man, with no obvious liver or gall-bladder disease at operation. The jaundice receded rapidly after operation. Simeone and Stewart (1940) described two cases of peritonitis after appendicectomy in which jaundice developed. In both cases haemorrhagic manifestations and evidence of liver failure occurred and both terminated fatally. Post-mortem examination, allowed in only one case, showed a diffuse central lobular necrosis of the liver. Only in one of many textbooks consulted is jaundice mentioned as a complication of peritonitis. Muir (1941) states that areas of necrosis may occur in the liver in acute peritonitis, but makes no mention of jaundice.

The six cases described below appear to fall into one category, for which the descriptive title of septic jaundice is suggested. The term "infectious" or "infective jaundice" carries the risk of confusion with infective hepatitis of viral origin, and "toxic jaundice" has been applied to jaundice caused by so many diverse agents that it lacks specificity.

Clinical Description

Details of the cases are shown in Tables I to IV. The histological findings in two further fatal cases of peritonitis following gastrectomy are included in Table IV for purposes of comparison. These two cases did not develop jaundice.

It will be seen that in all cases the operation involved the gastro-intestinal tract, and that post-operative complications were severe. Peritonitis, local or general, occurred in every case. Wound breakdown, subphrenic and intra-peritoneal abscesses, metastatic abscesses, faecal fistulae, abdominal wall abscess, and vesico-perineal fistula occurred, necessitating secondary operation in most cases. Unfortun-

TABLE I.—Pathological and Nutritional States

Case	Sex	Age	Pathological State	Nutrition	Diet
1	F	43	Carcinoma of stomach	Fair	Gastric
2	M	44	Gastric ulcer	"	"
3	M	51	Diverticulitis (localized)	Good	Normal
4	M	36	Gastric ulcer	Fair	Gastric
5	M	58	Carcinoma of rectum	Good	Normal
6	F	35	Intestinal obstruction due to multiple adhesions	"	"

TABLE II.—Details of Operations, Complications, and Treatment.

Case	Operation	Septic Complications	Jaundice: Onset and Duration	Transfusions*	Sulphonamides†
1	13/2/50: abdomino-thoracic total gastrectomy	16/2/50: ? peritonitis 22/2/50: drainage of peritonitis and right subphrenic abscess	17/2/50: jaundice till death on 24/2/50	13/2/50 (3) 17/2/50 (3)	23/2/51: sulphadimidine 2 g. I.M.
2	29/10/49: subtotal gastrectomy	2/11/49: Stomal obstruction—moderate 6/11/49: laparotomy—localized peritonitis and leak from suture line 10/11/49: multiple septic pulmonary infarcts 11/11/49: hypopyon	7/11/49: jaundice till death on 14/11/49	6/11/49 (1)	11-14/11/49: sulpha-triad 17 g.
3	17/11/50: partial colectomy, end-to-end anastomosis	26/11/50: faecal fistula in wound 29/11/50: resuture of wound	4/12/50: jaundice till death on 8/12/50	17/11/50 (1)	7-8/12/50: sulphadimidine 6 g.
4	25/10/47 partial gastrectomy	5/12/50: jejunostomy for intestinal obstruction 26/10/47: stomal obstruction—moderate 2/11/47: wound purulent 7/11/47: drainage of pelvic abscess 11/11/47: drainage of perigastric abscess 14/11/47: jejuno-jejunostomy for obstruction 24/11/47: wound fistulae, gastric and faecal 21/12/47: drainage right subphrenic abscess 4/1/48: Division of strangulating band	30/10/47: jaundice, fading after 17/11/47; conjunctival staining until 2/12/47. 26/2/48: jaundice recurred till death on 28/2/48	25/10/47, plasma (2) 30/10/47 (1) 11/11/47 (2), plasma (1) 14/11/47 (1) 4/1/48 (2), plasma (1)	5-7/11/47: sulphadimidine 14 g. 7-13/11/47: soluthiazole I.M. 35 g. 17-22/12/47: sulphadimidine 38 g. 11-16/1/48: sulphadimidine 30 g. 27/4/51-1/5/51: phthalylsulphacetamide 42 g.
5	2/5/51: abdomino-perineal excision of rectum	3/5/51: vesico-perineal fistula 6/5/51: abdominal distension	8/5/51: jaundice till death on 12/5/51	2/5/51 (3)	
6	28/9/50: division of multiple intestinal adhesions	29/9/50: abdominal pain and distension 7/10/50: wound oozing pus 16/10/50: ileostomy for obstruction. Three faecal fistulae developed in wound	3/10/50: jaundice till 29/10/50	16/10/50 (1) 29/10/50 (2)	

* Unless otherwise stated, transfusions were of stored blood; figure following date gives the number of pints.

† Sulphonamide dosage is shown as a total for each course.