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Massive colonic haemorrhage—the case for right hemicolectomy

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Summary

A total of 14 patients had operations for massive colonic haemorrhage. Of the seven who had a right hemicolectomy, four had the bleeding site localised, and three had only 'equivocal' indications of a right-sided source. One of these rebled 11 months later, but all survived and are well. Of the remaining patients, two had left-sided resection, one requiring an immediate second operation for rebleeding, and five, subtotal colectomy, of whom two died. A literature review confirms the suggestion that if the bleeding site has not been identified but, nevertheless, there are clues suggesting it to be right-sided, the best results will be obtained by right hemicolectomy. Left-sided resection should be used only when there is proof of left-sided bleeding, otherwise there will be an unacceptably high mortality. No clues, 'equivocal' indications of a left-sided source, or the presence of bilateral disease, should lead the operator to perform subtotal colectomy.

Introduction

We define massive lower intestinal haemorrhage as acute haemorrhage from a source distal to the duodenum requiring active measures beyond transfusion in order to save life. It is still a difficult surgical problem. This is due partly to the advanced age and debility of many patients, and partly to difficulty in identifying the bleeding point. Many authors advocate as reliable emergency measures either selective mesenteric angiography *(1–6)* or ^{99m}Tc-labelled red cell scanning *(7–10)*. However, others have found angiography disappointing *(7,11–13)* or even hazardous *(14,15)*. Furthermore, it is not available in many hospitals *(16)*, and many do not provide a scanning service. Even in those that do, the isotope may not be available on the 24-h basis which would be required for its effective use. In addition, the condition is relatively uncommon, and it is therefore difficult to justify the cost of expanding facilities to improve its management alone; operation has often to be performed without knowing the source of haemorrhage. This series, together with a literature review, substantiate a policy of right hemicolectomy in certain defined circumstances when the bleeding site is unknown.

Case material

The details are shown in Table I. They represent the experience of consecutive patients requiring surgery for massive lower intestinal haemorrhage from 1981 to 1986. They illustrate the variety of diagnoses and treatments and hence the difficulty in formulating a coherent management policy. Where necessary, up-to-date follow-up was obtained by post.

In our experience, relative youth assisted operative diagnosis. Patients 1–5 were all aged under 55 years and the cause of bleeding was demonstrable at laparotomy in four (though to find the cause in one of these required a caecotomy). The other patients were all over 70 years old and a definite cause was apparent at laparotomy in only two out of nine.

A preoperative diagnosis of the site of bleeding was made in only three patients, once by a ^{99m}Tc-labelled red cell scan, once by means of a preliminary transverse colostomy, and once by an angiogram. The latter suggested bleeding from an anastomosis, but the patient suffered two rebleeds following resection of this anastomosis. One of the other three emergency angiograms, all of which were also unhelpful, had to be terminated prematurely because of excessive haemorrhage. All seven of the patients with right-sided resections recovered, though three had their limited resection on the basis of negative or 'equivocal' laparotomy findings (Table I). One of these experienced a significant rebleed 11 months later. This was the patient with the positive angiogram who bled twice more after the second operation. Two others suffered minor rebleeds postoperatively, one requiring a blood transfusion of two units. These were considered irrelevant in view of the massive original

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TABLE I *Details of 14 patients with surgically treated massive colonic haemorrhage*

No	Age	Sex	Units blood	Main investigations	How bleeding site diagnosed	Final diagnosis	Associated disease	Operative management	Outcome S/D (comments)
1	25	M	36 total	Barium enema	Barium enema	Crohn's colitis		1 Subtotal colectomy 2 Proctectomy	S (rebleed after 1)
2	53	M	14	Gastroscopy, Barium enema, Angiography	Laparotomy, caecotomy	Multiple ileocaecal ulcers (non-specific)	Gastric erosions, Psoriatic arthropathy methotrexate	1 Vagotomy and pyloroplasty 2 Right hemicolectomy	S
3	35	M	6	Gastroscopy	Laparotomy-Crohn's	Crohn's of ascending colon		Right hemicolectomy	S
4	32	M	15	Gastroscopy, Barium enema, Technetium RBC scan, Angiography	Technetium RBC scan—pooling on right	Solitary caecal ulcer (non-specific)		Right hemicolectomy	S
5	39	M	?	Barium enema	Barium enema—Crohn's	Crohn's colitis	Chronic renal failure	Proctocolectomy + arteriovenous shunt	S
6	81	M	27	Angiography, Barium enema, Barium meal	Sigmoidoscopy, laparotomy	Radiation colitis post-Carcinoma bladder	Radiation cystitis	Sigmoid colectomy	S
7	80	M	12	None	Generalised diverticulae	Diverticular disease		Subtotal colectomy	D (48 h, irreversible shock)
8	75	F	18	Gastroscopy	Laparotomy—dilated veins on serosa of caecum*	Angiodysplasia (found on histology)		Right hemicolectomy	S (minor rebleed—no transfusion required)
9	73	M	12	Gastroscopy Technetium RBC scan	Laparotomy—ulcerative colitis	Ulcerative colitis	Gastric erosions, Multiple sclerosis, urinary incontinence	Intraoperative endoscopy of stomach and small bowel, subtotal colectomy, ileostomy	D (minor rectal bleed, 1 week; acute left ventricular failure 3 weeks)
10	70	M	12	Barium enema Attempted angiography†	Not found	Diverticular disease		Subtotal colectomy, ileorectal anastomosis loop ileostomy	S
11	82	M	10	Barium enema	Rebleed into blind transverse colostomy	Diverticular disease	Meckel's, multiple jejunal diverticula	1 Blind transverse colostomy 2 Extended right hemicolectomy	S (after major wound infection)
12	84	F	15	Gastroscopy	Intraoperative colonoscopy—fresh blood at splenic flexure‡	Diverticular disease	Recent MI, Thoracic aneurysm, Paget's of bone	1 Intraoperative colonoscopy, Left hemicolectomy 2 Right hemicolectomy, ileostomy	S (rebleed after 1; permanently on geriatric ward)
13	79	F	11		Intraoperative colonoscopy—fresh blood in asc. colon*	Unknown (histology unhelpful)	Melanosis coli, Diabetes, Multiple myeloma	Gastroscopy, intraoperative colonoscopy, Right hemicolectomy	S (minor rebleed—2 units transfused)
14	74	F	8	Gastroscopy Barium enema Colonoscopy Angiography Barium FT	1 Not found 2 ? bleed from anastomosis (angiogram)	Angiodysplasia (multiple, in large and small bowel	Pernicious anaemia Aortic stenosis	1 Right hemicolectomy‡ 2 Total colectomy, ileorectal anastomosis. (?anastomotic bleed 11 months later)	S (2 further rebleeds after op. 2, now none for 20 months)

* Equivocal finding followed by limited resection—successful
† Angiography abandoned because life-threatening haemorrhage in X-ray department
‡ 'Equivocal' or absent finding—limited resection—not successful

bleeds. Of the two patients submitted to left-sided resections, one had to be reoperated the same day, because an 'equivocal' colonoscopic finding had incorrectly influenced management. Of the five patients with subtotal colectomies, two died, one of acute pulmonary oedema 3 weeks postoperatively, and one, aged 80 years, 48 h after subtotal colectomy following prolonged preoperative shock.

Discussion

In this series we have found that patients aged under 55 years are more likely than those over 70 years to have an identifiable source amenable to segmental resection at laparotomy. It is the group of elderly patients that presents the main problem. In the likely event of finding no obvious bleeding site what is the correct operation for these patients? Informal enquiry has shown the popular answer to be 'subtotal colectomy', and this is confirmed in a widely respected text *(17)*. Examination of our results and also those published in the literature, however, suggests that this answer is often incorrect, and that circumstances can be defined in which right hemicolectomy is appropriate. The relevant data from the literature are summarised in Tables II–IV.

AIDS TO LOCALISATION OTHER THAN SOPHISTICATED INVESTIGATIONS

We emphasise that a right hemicolectomy performed when the site of bleeding is uncertain is not a substitute for the skilled use of investigations. Maximum possible use must be made of any clues that are available preoperatively. Bile alone in the nasogastric aspirate without shock or clinical indication of peptic ulcer disease *(18)*, and a plasma urea:creatinine ratio of less than 100 *(19)* exclude gastroduodenal lesions. Clotting defects *(20–23)* must be identified and anorectal examination should be performed with the greatest care, because there are reports that angiograms have demonstrated missed rectal lesions *(14,15,20)*. Even negative laparotomies have been performed before they were discovered *(3)*. In the absence of shock, bright red rectal bleeding is a reliable indicator of a low source. True melaena, ie black tarry as opposed to dark red stool, indicates the possibility of a small bowel lesion and may efficiently distinguish proximal from colonic bleeding *(14)*. Bleeding from diverticular is of arterial origin and is more likely to be located by angiography than bleeding from angiodysplasia, which is venous in origin *(1,3,5)*. Darker, less dramatic, blood loss may well come from the right colon, but the converse does not apply.

In a recent report, 13 of 34 cases were successfully treated by colonoscopic fulguration of angiodysplasia, five of which were actively bleeding at the time of the examination *(24)*. However, no comments were made on technical difficulties in the face of active haemorrhage and there is indication that the haemorrhage in that series was not as severe as in ours, transfusion amounts having ranged 'from 3 to 6 units of blood'. We have reservations about the advisability of attempting colonoscopic fulguration rather than resection when the bleeding is truly massive and the colon is full of blood.

Whether or not there have been positive preoperative investigations, there is an excellent case to be made for intraoperative colonoscopy *(21,25–28)*. Its technical ease is impressive and little time or trauma is added to the

TABLE II *Distribution of disease in patients coming to surgery after aggressive diagnostic work-up (angiography, scan, colonoscopy). The number of angiograms and unknown diagnoses are shown to give an indication of the thoroughness of the work-up. Amongst the 'other' diagnoses (neither angiodysplasia nor diverticular disease) were 21 small bowel causes*

			Diagnoses				
Reference	*n*	*ang.*	*a/d*	*d/d*	*oth*	*u/k*	% *a/d* + *d/d*
Casarella *et al. (2)*	21	21	1	13	5	2	66.7
Wright *et al. (4)*	22	11	4	11	7	0	68.2
Nath *et al. (5)*	19	19	5	9	3	2	73.7
Uden *et al. (6)*	26	25	5	14	5	2	73.1
Harvey *et al. (7)*	9	6	2	1	4	2	33.3
Kester *et al. (8)*	8	≥4*	1	2	5	0	37.5
Farrands and Taylor *(12)*	7	3	2	1	4	1	42.9
Athow *et al. (14)*	9	9	2	0	6	1	22.2
Britt *et al. (15)*	24	24	3	17	2	2	83.3
Giacchino *et al. (20)*	12	≥4*	2	2	8	0	33.3
Total	161	≥126	27	70	53	12	60.2

ang.=angiogram; a/d=angiodysplasia; d/d=diverticular disease; oth=other; u/k=unknown.
* Most patients in series had angiograms, but data incomplete in those having surgery

TABLE III *Unusual causes of massive colonic haemorrhage requiring surgery*

Disease	*Reference*
Colitis—ulcerative, Crohn's	12,35,36,p
Colitis—radiation	p
Colitis—ischaemic	26
Colitis—idiopathic	2
Tumours/polyps/snared polyp stalks	1,4,22,37
Ulcers—ischaemic, either side of colon	7,27,37
Ulcers—caecal, non-specific	38,39
Ulcers—caecal, associated with cytotoxic therapy	1,p
Ulcers—multiple, non-specific	26
Anastomotic bleed	7,12
Multiple colonic angiomata	27
Caecal varices	20
Hereditary haemorrhagic telangiectasia	40
Arteriocolic fistula due to aortic or splenic aneurysm	12,15,41
Arteriocolic fistula due to radiotherapy	42
Arteriocolic fistula due to diverticular disease	43
Tuberculosis	44
Typhoid	45,46
Paratyphoid	47
Amoebiasis	48
Cytomegalovirus/AIDS	49
Appendix abscess	50
Non-absorbable suture at appendix stump	51
Anticoagulants	20,21
von Willebrand's disease	20,22,23
Haematological abnormalities with or without associated cytotoxic or immunosuppressive therapy	20
Systemic lupus erythematosus	52
Abdominal pregnancy	53

p=present series

TABLE IV *Results of operations for massive colonic haemorrhage: data pooled from the papers with adequate information, 1970–1988 (1–5,7,8,11,12,14,20–22,24–27,30,31,34,54–60). In most papers the data were found to be inadequate to define links between rebleeding and death. However, we were able to ascertain that three of the deaths after equivocal right hemicolectomy were* not *due to rebleeding (Steger AC, personal communication)*

Operation	*n*	*Deaths (%)*	*Rebleeds (%)*
Equivocal/blind resection			
Right hemicolectomy* X_1X_2	78	4 (5.2)	15 (19.2)
Left-sided resection	69	22 (31.9)	27 (39.1)
Left-sided resection (excluding ref. *11*)† X_1	41	8 (19.5)	17 (41.5)
Limited resection, left probable *(30)*‡	23	7 (30.4)	8 (34.8)
Definite+probable left-sided resections	92	29 (31.6)	35 (38.0)
Subtotal colectomy X_2	94	15 (16.1)	2 (2.1)
Bleeding site demonstrated			
Right hemicolectomy	81	8 (9.9)	4 (4.9)
Left-sided resection	36	4 (11.1)	0 (0)
Limited resection, side not stated *(2,31)*	19	2 (10.5)	1 (5.3)
Total	136	14 (10.3)	5 (3.7)

* One report *(22)* is included, in which it was not stated whether extravasation of blood into the gut had been demonstrated. Enquiry has revealed that in 'nearly all' the 29 cases it was not (Steger AC, personal communication).
† Mortality 50% in that series *(11)*.
‡ Likely to be left-sided resections because early series (1943–1972), data on diverticular disease only, no sophisticated investigations, not generally known at that time that bleeding from diverticular disease commonly on right. It is difficult to envisage the surgeon performing a right hemicolectomy under those circumstances *(30)*.
X_1—χ^2 for mortality in these two groups (4/78 vs 8/41)=4.65, $P<0.05$
X_2—χ^2 for mortality in these two groups (4/78 vs 15/94)=4.40, $P<0.05$

operation. Two experienced operators are required. One starts colonoscopy as soon as the patient is anaesthetised and in the Lloyd-Davies position, while the other prepares the abdomen and makes the incision. The completion of the colonoscopy is assisted by the abdominal operator, who can obtain clues by transillumination of the bowel wall. The subsequent procedure depends on the preoperative, operative and colonoscopic findings. If excessive blood obscures the view, the bowel is cleared by irrigating through a catheter placed in the caecum. Good and complete views may be obtained of the colonic mucosa in this way. The colonoscope can equally well be passed per oram if there is reason to suspect a small bowel rather than a colonic cause, or an anally introduced endoscope can be fed into the small bowel which is then concertinaed over it *(28,29)*. The authors have limited experience of the latter technique or of endoscopy via an enterotomy.

TIMING OF OPERATION

Operation should not be embarked on prematurely, as it was in one series, in which subtotal colectomies were performed after transfusion of an average of only 4.5 units of blood *(30)*. If less than 3 units of blood are required on the first day of a bleed then the patient will not require emergency surgery *(4,31)*. After a rebleed there is only a 50% chance of a second rebleed *(31)*. It is therefore worth waiting until a third bleed before considering surgery, unless haemorrhage is so rapid that it is immediately life-threatening. Waiting beyond a 10 unit transfusion is unjustifiable in our view and prompt action should be taken at that point.

'EQUIVOCAL' RIGHT HEMICOLECTOMY

In this series there were three right hemicolectomies undertaken with no bleeding site demonstrated. Two were 'equivocal' in that there was an identifiable right colonic abnormality, but this was not proven to be the source of bleeding. All three patients survived, though the two 'equivocal' cases had early minor rebleeds. The causes of the rebleeding were not determined, but the minor nature makes it unlikely that it was from the original sources, and it did not affect the outcome. These three patients would not have stopped bleeding without operation. They had bled 18 pints of blood in 48 h, 11 in 24 h, and 8 pints in 7 days respectively. The last patient rebled 11 months later. The remaining colon was removed because of diverticular disease, but that too was followed by recurrent bleeding. The failure of the right hemicolectomy cannot therefore be used as an argument for subtotal colectomy. There must have been either multiple sources of bleeding, or an isolated small bowel lesion which has, to date, been missed.

Apart from a single case report of its use *(32)*, 'equivocal' right hemicolectomy was not mentioned until 1979 when Boley *et al.* suggested that it is acceptable because most bleeding occurs on the right *(1)*. Angiodysplasia nearly always occurs in the caecum *(1–3)*, and two-thirds of bleeding from diverticular disease is on the right, even though that disease is mainly on the left *(3,31,33,34)*. However, when all patients that have come to surgery after an aggressive diagnostic work-up are considered, those two conditions account for less than two-thirds of bleeds (Table II). Small bowel causes make up just under one-third of the remainder. The rest are either unknown or caused by a variety of conditions, a list of which is shown in Table III. Therefore, if all lower intestinal haemorrhage requiring surgery is considered, a completely blind right-sided resection may not be relied on to stop the bleeding.

However, the alternative of subtotal colectomy results in the burden of either a temporary stoma or frequent loose stools in an elderly debilitated patient. These factors may result in permanent institutionalisation and should not be underestimated. Furthermore, reported mortality of subtotal colectomy performed for bleeding is, at best, 11% and to achieve this required early operation after an average of only 4.5 units of blood *(30)*. Such early intervention will lead to some unnecessary operations being performed, as spontaneous cessation of bleeding may occur even after 10 units have been transfused *(7)*. In other series the mortality of subtotal colectomy has been up to 50% *(1,20,31)*. Overall mortality has been reported to be 5% or less in centres with expertise in angiography making possible a greater proportion of limited resections *(1–6)*. The likelihood of stopping the bleeding by subtotal colectomy has to be balanced against these considerations.

What have others found to be the consequence of performing a partial colectomy when the bleeding site has not been demonstrated? The answer provided by our literature review is shown in Table IV. In 27 reports

between 1970 and 1988 there are records of 78 'equivocal' or blind right hemicolectomies, with only four deaths (5.2%) despite a 19.2% rebleeding rate. Three of the deaths occurred in patients who had been subjected to angiography *(22)*, and none of these were due to rebleeding (Steger AC, personal communication). This suggests the possibility that the investigation was occasionally hazardous (as in one of our cases), perhaps because it caused excessive delay in some patients coming to surgery. The fourth death is poorly documented; some months after a successful colonoscopic fulguration of right-sided angiodysplasia, death apparently occurred from recurrent left-sided bleeding after a right hemicolectomy at another hospital *(24)*. In contrast to right hemicolectomy, 'equivocal' or blind left-sided resection was associated with, at best, a 19.5% mortality, an overall mortality of around 31% and a rebleed rate of 38%. The high rebleed rate is presumably mainly due to inappropriate resection of left-sided diverticular disease. The mortality of subtotal colectomy was 16.1%, while demonstration of the bleeding site followed by a segmental resection reduced this figure to 10.3%. The improved mortality after right hemicolectomy is statistically significant when compared with both left hemicolectomy ($\chi^2=4.65$, $P<0.05$) and subtotal colectomy ($\chi^2=4.40$, $P<0.05$).

These findings suggest that, if the bleeding site has not been demonstrated, 'equivocal' right hemicolectomy is a relatively safe procedure, with a lower mortality than either 'equivocal' left hemicolectomy or subtotal resection. Indeed, it appears to achieve a better survival rate than in those series where the bleeding site was demonstrated, even though one-fifth of the patients rebled. The data in the literature are insufficient to indicate how many of these rebleeds required a second operation. An explanation as to why rebleeds should be associated with a lower mortality after right than after left-sided resection may stem from a report of hypertension in patients with diverticular disease *(54)* and the knowledge that the colon has a richer blood supply on the right. Perhaps these factors combine to make bleeding from the right more dangerous.

The 20% rebleed rate after right hemicolectomy for proven angiodysplasia *(2,3,22,60)* is not surprising. These operations are usually 'equivocal' in that angiodysplasia does not usually provide evidence of extravasation *(1,3,5)* and, like diverticular disease, is present incidentally in 50% of post-mortem studies *(61,62)*. It is also sometimes found in multiple sites *(3,25,56,61)*. All the rebleeds were from small bowel or proximal sites *(3,22,60)*, except where a second angiodysplasia was found in the right transverse colon after too limited a right hemicolectomy *(3)*, or associated diverticular disease on the left had been mistakenly ignored *(1,4)*. Angiodysplasia is therefore not uncommonly an incidental finding associated with a more proximal lesion. In the absence of diverticular disease, subtotal colectomy for an incidental angiodysplasia would be a much worse mistake than right hemicolectomy.

The small bowel is almost as likely a site for bleeding as the left colon. Subtotal colectomy is, therefore, illogical unless there is definite evidence of ulcerative disease in the left colon.

It seems that if an 'equivocal' operation is forced upon the surgeon, right hemicolectomy is safer than subtotal colectomy. We accept a 20% rebleed rate because it is unlikely to result in the death of the patient, even if reoperation becomes necessary *(1)*, and it may be a small bowel lesion rather than a left colonic lesion which has been missed. Knowledge of the rebleed rate and the element of doubt left by the failure of an early author *(30)* to report the side of resection (though it seems likely it was left—see note to Table IV), lead to limitation of our recommendation for right hemicolectomy to those cases where there is an isolated right-sided colonic abnormality, rather than to recommend it as a completely blind procedure. However, it is prudent to make a careful search of the proximal bowel by intraoperative colonoscopy if angiodysplasia has been diagnosed or if there is true melaena.

OPERATIVE POLICY

If the bleeding site is identified, the appropriate segmental resection is performed. If not, but there are clues to isolated right-sided pathology, right hemicolectomy is carried out as justified above. Such clues may be non-bleeding lesions seen either by angiography or colonoscopy, fresh blood on colonoscopy at one site with no obvious lesion, or laparotomy findings such as caecal thickening, or abnormal serosal blood vessels *(1)*. The resection should include the right half of the transverse colon because angiodysplastic lesions may be sited there *(3)*. If bilateral diverticular disease is present *(1,3,30,31)*, or if there has been a previous unsuccessful right-sided procedure *(24)*, or if there are no clues, or clues on both sides of the bowel (for example, angiodysplasia on the right and diverticular disease on the left), then subtotal colectomy is carried out. This is more likely to be the case in the elderly patient with diverticular disease. In the younger patient, subtotal colectomy is unlikely to be appropriate, unless the diagnosis is inflammatory bowel disease. The cut bowel ends can either be exteriorised, or anastomosed with or without the protection of a defunctioning loop ileostomy, depending on technical considerations and the condition of the patient.

It is reasonable to assume that the bleeding is left-sided, as advocated by Wright *(4)*, *only* if the following criteria are fulfilled: rectal bleeding is dramatic and bright red without shock or other indication of a proximal source; skilled proctoscopy is negative; technically satisfactory colonoscopy has revealed neither blood nor a mucosal lesion on the right, and diverticular disease is limited to the left. Only then would we be prepared to undertake left-sided resection. All the diverticula-bearing area must be removed. This may be either a sigmoid or a left hemicolectomy depending on the distribution of the disease.

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Notes on books

Advances in Urologic Oncology edited by N Javadpour and G P Murphy. 150 pages, illustrated. Alan R Liss, New York. $48.00.

The Proceedings of a Symposium held in Baltimore in April 1987. Each of the papers is printed from camera-ready copy and as different typewriters have been used the result is rather untidy to the eye. Nevertheless, the articles are authoritative and give a concise overview of current American thought about urological malignancy.

Anatomical Dissections for Use in Neurosurgery, Volume 2 by Wolfgang Seeger. 314 pages, illustrated. Springer-Verlag, Wein. DM 228.

A practical atlas of anatomical dissections of the human brain with special reference to magnetic resonance imaging. Comparison of MR images and anatomical dissections in three dimensions should help neurosurgeons and neuroradiologists to develop spatial perception. Large format and uncramped layout make for ease of study.

Operative Ultrasonography during Hepatobiliary and Pancreatic Surgery edited by B Deixonne and F-M Lopez. 134 pages, illustrated. Springer-Verlag, Berlin. DM 148.

Intraoperative ultrasound is being increasingly used in the surgery of the liver and pancreas. It may be expected that a number of books relating to this new technique will be issued in future months. Beginners in the field will need guidance and this short text should prove of considerable help. Clear illustrations, concise text and amply referenced.

Hardy's Textbook of Surgery edited by James D Hardy. 2nd edition. 1414 pages, illustrated, paperback. J B Lippincott Company, Philadelphia. £25.00.

A comprehensive multi-author textbook of surgery. Gynaecology, neurosurgery, orthopaedic surgery, plastic surgery, paediatric surgery and cardiac surgery are all included, as is usual in American surgical texts. Operative detail is also covered as well as pathology and presentation of various diseases. Key references are given and much use is made of summary tables which reduces the amount of text. Extremely good value for money although the soft binding makes for an unwieldy volume for armchair reading.

Microsurgical Reconstruction of the Extremities: Indications, Technique and Postoperative Care by Leonard Gordon. 186 pages, illustrated. Springer-Verlag, New York. DM 325.

The objective of this volume is to provide the microvascular surgeon with practical information on technique. Muscle transplantation, cutaneous transplantation, bone transplantation and digital replantation are all covered in considerable detail. Each chapter is copiously illustrated with high-quality photographs, many in colour, and the experience and expertise of the author shines throughout. The many references to further reading are all annotated with a concise summary which adds to the value of the book. There is no doubt that trainees and experienced microvascular surgeons alike will find much of interest contained within its pages and it is thoroughly recommended.