BURST ABDOMEN*

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Abdominal wound disruption has been the subject of numerous investigations in the past, and many series of cases have been reviewed.[1, 2, 4, 7] There is, however, no unanimity of opinion as to the relative importance of the various aetiological factors. It was decided to search the clinical records of the Manchester Royal Infirmary, in the hope of shedding further light on this problem.

Present Investigation

Material.—During the eight-year period 1950-57 there were 89 burst abdomens in the Manchester Royal Infirmary. These are cases in which there was complete disruption of all layers of an abdominal wound. Cases in which only the superficial layers gaped, usually due to haematoma or sepsis, and cases in which it was recognized that the deep layers had parted but the skin remained intact, are excluded. The latter, although aetiologically the same as burst abdomens, will present as incisional herniae.

Sex.—In this series there were 70 males and 19 females, a ratio of 3.7 to 1.

Age.—The age distribution of these cases is shown in Fig. 1. The majority of the patients were in the sixth and seventh decades.

Conditions Requiring Operation.—The conditions for which these patients had undergone operation were as follows:—

		Cases
Peptic ulcer		39
Duodenal ulcer	16	
,, perforation	4	
,, haemorrhage	2	
Gastric ulcer	11	
,, haemorrhage	5	
Stomal ulcer	1	
Malignant disease		23
Stomach	8	
Large bowel	7	
Pancreas	3	
Other	5	
Cholecystitis		9
Appendicitis		6
Other		12

* Based on a paper read before the Section of Surgery, Manchester Medical Society, on March 10, 1959.

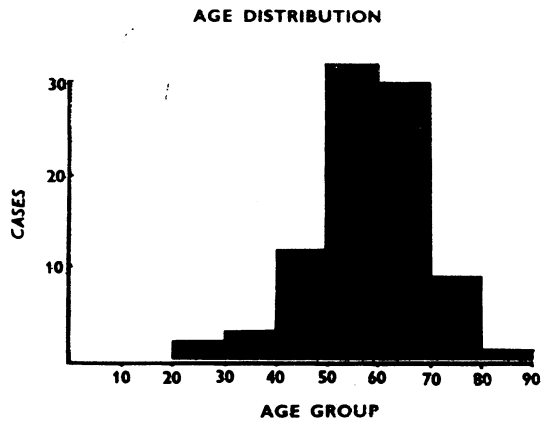

FIG. 1

General Condition.—Information about the general condition of these cases before operation is incomplete, but the majority were reported to have been fit subjects; 35 per cent. were noted to be suffering from a cough, and 24 per cent. were anaemic to the extent that the haemoglobin was less than 70 per cent. of normal. Obesity was noted in 15 per cent., and 14 per cent. were hypertensive to the extent that the diastolic pressure exceeded 100 mm. Hg.

Operations.—The operations which had been performed were as follows:—

	Cases
Partial gastrectomy	24
Gastroenterostomy and vagotomy	12
Laparotomy	11
Cholecystectomy	8
Appendicectomy	7
Suture of perforation	5
Others	22

All the operations had been performed under general anaesthesia with the exception of one which was under spinal.

Incisions.—All but four of the incisions in this series were vertical. Their situation was as follows:—

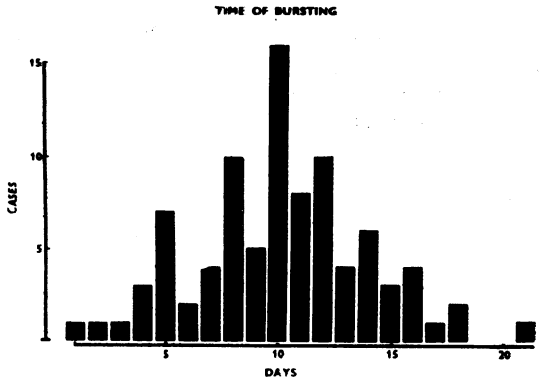

FIG. 2

		Cases
Paramedian		77
Upper	62	
Lower	9	
Middle	6	
Mid-line		8
Upper	5	
Lower	3	
Thoraco-abdominal		2
Oblique muscle-cutting		1
Gridiron		1

It will be seen that the majority are upper abdominal incisions. It was not possible to determine the relative incidence of burst abdomen for mid-line and paramedian incisions owing to incomplete records, but a rough check suggested that the incidence was of the same order for the two incisions.

Various methods had been used to close the original wounds, including continuous and interrupted sutures of absorbable and non-absorbable material. All in which the method was stated were closed in layers, and the commonest method was with continuous catgut to anterior and posterior rectus sheath, with or without tension sutures.

Time of Bursting.—The commonest time for the wound to burst was on the tenth post-operative day (Fig. 2). In most cases the burst became apparent shortly after the skin sutures were removed.

Method of Repair.—These wounds were all resutured, most of them in one layer with ' through and through ' stitches of stout nylon or linen thread. A few were resutured in layers. All but one were resutured under general anaesthesia.

Subsequent Fate.—Fifteen per cent. of these patients failed to leave hospital alive. The average duration of stay in hospital after resuture of the wound was 28 days, indicating that recovery was not always smooth. Of those who were subsequently examined as outpatients, 39 per cent. were noted to have developed incisional herniae. The true incidence is probably greater, because the state of the wound was not always recorded in the case notes.

Incidence.—In order to make some estimate of the incidence of burst abdomen, the total number of certain abdominal operations performed was ascertained, and the percentage incidence for these operations was calculated.

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	No. of Cases	Bursts	Incidence (per cent.)
Partial gastrectomy	994	21	2.1
Splenectomy	125	2	1.6
Gastroenterostomy, etc.	724	9	1.2
Suture of perforation	410	5	1.2
Cholecystectomy	881	6	0.7
Abdomino-perineal resection	154	1	0.7
Partial colectomy	196	1	0.5
Total	3,484	45	1.3

The incidence of burst abdomen was also calculated for several individual operators. For this purpose the total number of transperitoneal operations, other than herniorrhaphies and appendicectomies, performed by these surgeons was ascertained. During the eight-year period covered by this review 2,816 such operations were performed by five individual surgeons, all of whom employ predominantly paramedian incisions and close them by substantially the same method, i.e. with continuous catgut to anterior and posterior rectus sheath. There were 31 burst abdomens—an incidence of 1.1 per cent. The incidence for individual operators varied from 0.3 per cent. to 3.0 per cent.

Discussion

Theoretically two factors may be concerned in the causation of burst abdomen. Either the intra-abdominal pressure is too great, or the wound is too weak.

Factors causing increased intra-abdominal pressure, such as cough, ileus and obesity, were noted in some cases in this series and were doubtless the predisposing cause of some of the wound disruptions. As, however, the intra-abdominal pressure is frequently not within the surgeon's control, the wound must be made sufficiently strong to withstand this pressure.

During the post-operative period a wound must depend for its strength on three things: (1) The cohesion of the healing tissues, (2) the bandages and dressings and (3) the sutures.

Immediately after an operation it is obvious that the wound must depend entirely on the

sutures and the dressings and bandages for its cohesion. As the days pass, one would expect the healing tissues to make an increasing contribution to the strength of the wound. According to Whipple,[6] a wound does not begin to gain in tensile strength until the fourth or fifth post-operative day.

Circumstances which may delay wound healing, such as hypoproteinaemia,[5] vitamin C deficiency[3] and malnutrition have been suggested as causes of burst abdomen. These conditions may have affected some cases in the present series—precise information is lacking because it was a retrospective survey. However, the majority of these patients were reported to have been in good general condition before operation. Less than a quarter were anaemic and barely a quarter were suffering from malignant disease. Wound sepsis might be expected to delay healing, but this was noted in only a few cases in this series; and the incidence of burst abdomen was less for the potentially septic operations on the colon than for the relatively clean operations on the upper alimentary tract. The present series, therefore, does not offer any positive evidence to incriminate factors which delay wound healing as an important cause of wound disruption in the majority of cases.

In this series most of the wounds burst shortly after the skin sutures were removed. When the wounds were explored it was usually noted that the abdominal contents were adherent to the layers of the wound. Rupture of the deep layers had clearly occurred some days before the burst became apparent, and the abdominal contents had been retained only by the skin sutures. Moreover, in several cases clinical evidence of this was noted: there had been a discharge of serum from the wound, or a deficiency in the deep layers had been palpable early in the post-operative period. It thus appears likely that disruption of the deeper layers of the wound occurs during the first few days after operation, before tissue healing offers a significant contribution to the strength of the wound. It is therefore necessary to consider by what mechanism the sutures give way. There are four possibilities:—

(1) *The suture material is absorbed before healing has occurred.* If the deep layers part within a few days of operation, then absorption of catgut would seem unlikely to be a factor. Moreover, in several cases in this series the deep layers had been sutured with non-absorbable material.

(2) *The suture breaks.* If this were the usual mechanism, surgeons who habitually use the thicker grades of catgut ought to have a lower incidence of burst abdomen than those who use the finer grades. This has not happened. Moreover, in several of these cases the deep layers were sutured with No. 35 linen thread, which would seem unlikely to have snapped.

(3) *The knots become untied.* It is conceivable that if an assistant were to cut close to the knot at the end of a continuous catgut suture, or if the knot were faultily tied, it might come undone and the suture unlace itself, allowing disruption to occur. However, in some of the wounds which burst the deep layers had been sutured with interrupted stitches, and one cannot envisage a dozen knots becoming untied at once.

(4) *The sutures cut out.* In a considerable number of burst abdominal wounds personally inspected, it has been noticed that the suture material and knots are intact, and that the sutures have cut out from the tissues constituting the layers of the wound. It is suggested that this is the commonest mechanism by which disruption occurs.

Conclusions

Burst abdomen may occur in two different types of patient:—

(1) Those suffering from advanced malignant disease, malnutrition, debility, etc., in whom wound healing is deficient; and

(2) Relatively fit patients in whom the deep layers of the wound are torn apart in the immediate post-operative period. This may happen as the result of a violent bout of coughing, possibly before the patient leaves the operating table.

The latter is the commoner type.

If, as suggested, wounds usually burst because the sutures cut out, then whatever method is used to suture the abdominal wall in layers, whether with continuous or interrupted sutures —absorbable or non-absorbable—the wound will still be liable to burst if subjected to undue stress in the early post-operative period.

The only closure which would appear immune from the risk of bursting by this mechanism is the use of 'through and through' stitches. No wound closed in this way has burst in the present series, and no burst abdomen resutured with 'through and through' stitches has burst a second time. It is not suggested that all wounds should be repaired with 'through and through' stitches simply to avoid a 1 per cent. chance of wound disruption. It would, however, appear reasonable to consider the method in selected cases where for any reason a wound is considered especially likely to burst.

When wounds are sutured in layers it would seem that attention should be directed to those points in technique which might lessen the chance of sutures cutting out. The stitches should be

placed close together so that the stress is shared among a greater number of stitches, mattress sutures should be used, the ' bite ' of the stitches should not be too small, and they should not be tied so tightly as to devitalize the tissues within their grasp.

Summary

1. A series of 89 burst abdomens occurring in the Manchester Royal Infirmary during the years 1950-57 is reviewed.

2. The incidence of burst abdomen is found to be of the order of 1 per cent., and to depend more upon the operator than on the operation, the incision, or the method of closure.

3. The mechanism of wound disruption is discussed, and it is suggested that deficient wound healing is of less importance than defective suturing, and that wounds burst because the sutures in the deep layers of the wound cut out.

4. It is concluded that, for the prevention of burst abdomen, careful technique in suturing the abdominal wall is more important than the use of any particular method or suture material.

Acknowledgments

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