Abdominal Drains:

Their Role as a Source of Infection Following Splenectomy

ELMO J. CERISE, M.D., WILLIAM A. PIERCE, PH.D.,
DANIEL L. DIAMOND, B.S.

From the Departments of Surgery and Microbiology, Tulane University Medical School, New Orleans, Louisiana

SURGEONS have placed drains within the abdominal cavity for centuries despite the uncertainty which questions the extent of their beneficial effect. Hippocrates[5] used drainage tubes in the treatment of empyema and probably inspired by this, Celsus[1] later used them in the treatment of ascites. In 1887, Tait[9] advocated a dictum still invoked by many today: "When in doubt, drain." However, two of his contemporaries, Von Ott[10] and Delbet,[10] each noted that general peritoneal drainage is a physical and physiological impossibility. This statement was proved in 1905 by Yates[10] whose monograph is a classic on the subject of abdominal drains. Yates also concluded that drains should be made of the least irritating material, that they should be removed as soon as possible within the limits of a gradual withdrawal, and that they are encapsulated within 6 hours unless retarded by such things as profuse drainage. He further stated that there is an inward current from outside the general peritoneal cavity, though his experiments lack proof to substantiate this. Robb and Ghriskey,[6] in 1891, cultured organisms from the bottom of the wick in nine of 16 instances of cigarette drains placed within the abdomen. They believed that the organisms had probably moved down the drain. Although this belief is stated in surgical texts,[4] there has been no reported experiments to prove that organisms are capable of migrating down abdominal drains.

More recently, the question of whether or not to employ drainage has again been raised, particularly with regard to the left subphrenic area following splenectomy. Cohn[2] reported clinical statistics which strongly suggest that drainage of this area enhances the possibility of local infectious complications. Daoud *et al.*,[3] after reviewing their case material, were of the opinion that the local infection rate in drained and undrained groups was equal, if the clinical course of left subphrenic inflammation is accepted as infection in the splenic fossa. They concluded, therefore, that drains did not increase the incidence of subphrenic infection.

The following study was undertaken to determine: 1) if pathogenic bacteria are in fact capable of migrating down drains into the peritoneal cavity, and 2) the clinical experience in Charity Hospital of New Orleans, regarding the incidence of infection when drains were and were not used after splenectomy.

Experimental Work

Materials and Methods

Fifty-two New Zealand rabbits paired by sex and weight were anesthetized with intravenous pentobarbitol. After each abdo-

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men was shaved and prepared with ether, a splenectomy was performed through a midline incision. In 31 rabbits, a small Penrose drain was placed into the splenic bed through a stab wound in the left side and sutured to the skin. No drain was used in the 21 control animals. An aliquot of quantitated Group A type 6 streptococcus was placed on the skin around the drain, care being taken not to touch the drain with the inoculum. An aliquot was placed in a similar location on the control animals (Fig. 1). Sterile dressings were applied and except for two drained rabbits that died within 24 hours, the animals were sacrificed 24 and 72 hours following splenectomy. The splenic bed was exposed through a left thoracic transdiaphragmatic approach. Cultures were taken of the skin, the deepest centimeter of the drain, and the surrounding splenic bed.

Results

The type 6 streptococcus applied to the skin at the time of operation was recovered in cultures of the skin in all but two rabbits, both drained, at the time of sacrifice or death.

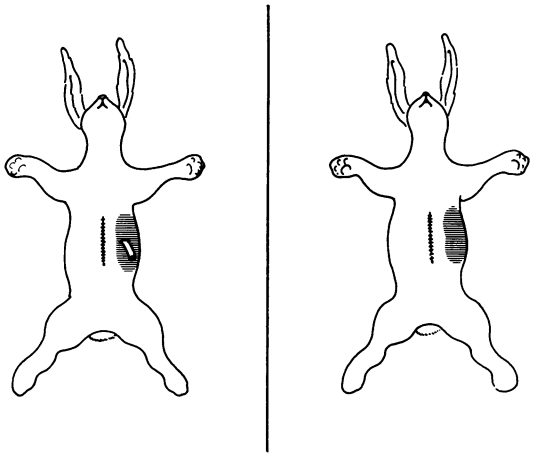

FIG. 1. Diagram representing (A) incision, inoculation, and drain sites in the 31 drained rabbits and (B) incision and inoculation sites in the 21 undrained rabbits.

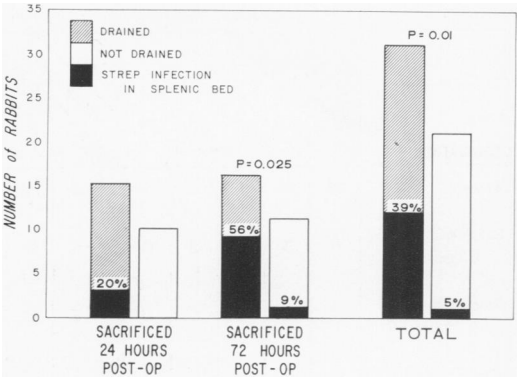

FIG. 2. Percentage of type 6 streptococcus recovered in cultures of the splenic bed.

The specific organism was recovered in cultures of the splenic bed at the time of sacrifice or death in 12 (39%) of the animals which received drains. In addition to being recovered in cultures of the splenic bed, it was also cultured from the heart's blood of the two animals which dried prior to sacrifice. It was cultured from the splenic fossa of one (5%) control rabbit. This percentage difference is significant (p—0.01) (Fig. 2).

The test organism was recovered in cultures of the splenic bed in 20% of drained rabbits sacrificed in 24 hours and in 56% of those drained and sacrificed in 72 hours. The increased number of infections after a longer period of exposure to drainage and contamination may indicate a trend which would prove to be statistically significant with greater numbers of animals.

From this study, therefore, one can conclude that pathogenic organisms can and do move down a drain to cause intraperitoneal infection. Although it does not determine at which time organisms are most likely to infect the splenic bed, the fact that three rabbits had type 6 streptococci in the splenic bed within 24 hours of splenectomy indicates that drain-incurred morbidity may begin in the immediate postoperative period.

COMPLICATION	Condition responsible for splenectomy: Trauma	Iatrogenic injury	Resected en bloc	Hematologic diseases	Portal decompression	Not contaminated	Potentially contaminated	Definitely contaminated	Drained	Not drained	TOTAL
Abscess	16	8	1	3	1	6	12	11	28	1	29
Subphrenic Inflammation	6	3	3	2	0	5	5	4	10	4	14
Pancreatic fistula & pancreatitis	11	2	4	0	0	5	8	4	12	5	17
Wound Infection	8	5	8	0	1	1	12	9	16	6	22
Drain site infection	7	2	1	3	0	5	8	0	13	0	13
TOTAL PATIENTS STUDIED	282	99	66	77	8	224	231	78	295	238	

FIG. 3. Associated infectious complications.

Clinical Material

Materials and Methods

A survey was made of records of patients undergoing splenectomy during the 10-year period from 1958–1967 at the Charity Hospital of Louisiana in New Orleans. This phase of the study was to determine the role of drains in the development of postoperative infections, especially inflammation and abscess formation in the splenic bed. Of the 559 cases studied, 533 survived at least 4 days postoperatively, a period considered long enough to make them suitable for study. Of this number, 295 (55.4%) had been drained and 238 (44.6%) had not. In almost all instances of drainage, a Penrose drain or drains were placed through a stab wound in the upper left quadrant of the abdomen.

The patients were categorized as *uncontaminated, potentially contaminated,* and *contaminated* because it was felt that exposure to contamination would be of primary importance in the development of postoperative infection. They were classified as *uncontaminated* if the spleen alone was removed at operation, usually because of blunt trauma or hematologic conditions. Those in whom splenectomy was a result of injury to the spleen in the course of gastrectomy or of trauma which also involved injury to the pancreas or liver were classified as *potentially contaminated.* Instances in which there was obvious gross spillage of colon or abscess contents into the area of the splenic bed were classified as *contaminated.*

The patients were also categorized as to the indication for the splenectomy: trauma, iatrogenic injury, resection en bloc, hematologic diseases and portal decompression.

Results

All of the preceding categories and the associated infectious complications are shown in Figure 3.

The most significant finding of this analysis is that of 29 patients who developed left subphrenic abscesses, 28 had been drained. In addition, those drained had a greater incidence of left subphrenic inflammation. This is statistically significant in all except the definitely contaminated category in which the number of cases is too small (Fig. 4).

The greater incidence of all complications, other than drain site infections, in

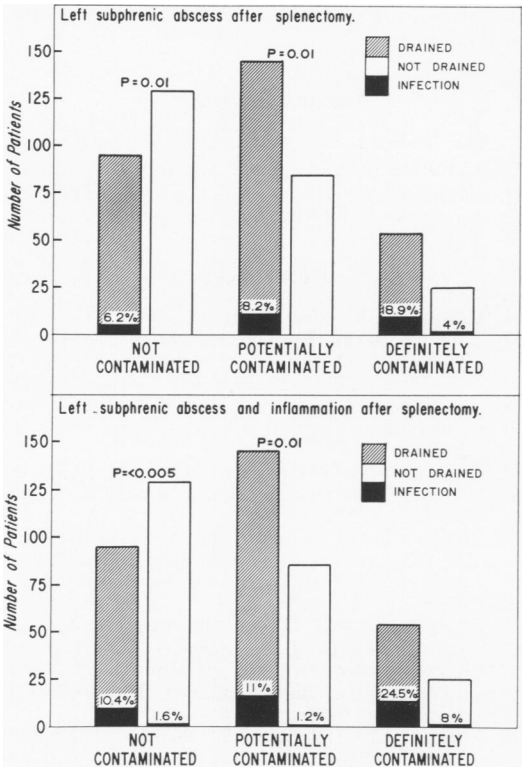

FIG. 4. Incidence of left subphrenic abscesses after splenectomy.

those drained (22%) as compared to those undrained, (7%) is impressive. If one adds to this unbalanced comparison the 18 drain site infections for a total of 27% of drained cases with serious complications, the result is highly significant (Fig. 5).

Discussion

Some surgeons advocate routine use of drains in the splenic fossa following splenectomy. The reasons usually cited favoring drainage are that they tend to prevent infection by removing blood and serum which collects in the large dead space and by removing any pancreatic fluid likely to accumulate as a result of inadvertent injury to the tail of the pancreas. Others suggest that the drain may alert the surgeon to early postoperative hemorrhage. It is interesting that while advocating routine

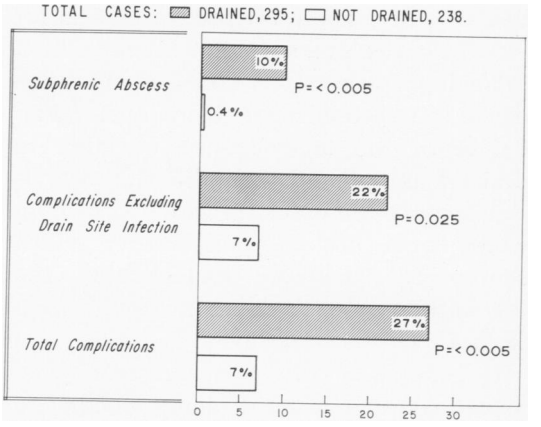

FIG. 5. Subphrenic abscess complications.

drainage, Schwegman and Miller[8] report that left subphrenic abscess "has been our most prevalent major postoperative complication (excluding wound infection), occurring in 9% of cases in which the operative procedure was directed primarily at the spleen." Sedgwick,[7] who also recommended routine drainage notes, "Subdiaphragmatic abscesses are more frequent after splenectomy than any other abdominal procedures. This can be prevented by taking care not to injure the pancreatic tissue and by instituting drainage through a stab wound in the flank in all cases of splenectomy."

This study experimentally establishes that pathogenic bacteria are capable of migrating down an abdominal drain into the peri-

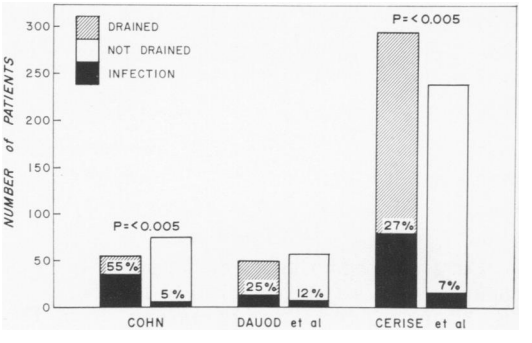

FIG. 6. Infection complication rate following splenectomy.

toneal cavity. The retrospective clinical review of drains as a source of contamination following splenectomy confirms the incidence of infection reported by others (Fig. 6). Since the incidence of infection in drained as opposed to undrained cases is significantly different precisely in those which were not contaminated or which were only potentially contaminated, the use of prophylactic drainage would seem to be especially hazardous.

It is apparent that there are many factors to consider when deciding whether to drain or not to drain, and each must be properly assessed in the light of current knowledge, experience, and particular circumstances. Our clinical and experimental information indicates that drains are a potential source of trouble and that they should be used only when definitely indicated. They should not be used after splenectomy unless there has been definite associated contamination. Once in place, they must be carefully managed with sterile precautions and removed as early as possible, remembering that they remain a constant source of contamination.

Conclusions

The use of abdominal drains in the splenic bed has been shown to be a potential source of contamination in both experimental animals and in patients. These studies and those of others would indicate that drains should not be used routinely after splenectomy, and that their use be reassessed in other clinical situations, particularly when they are used prophylactically.

Acknowledgment

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Discussion

Dr. Hunter McGuire (Richmond): My presentation is, in a sense, a minority opinion, since my sample is considerably smaller than Dr. Cerise's, and because I disagree with his conclusions.

At the Medical College of Virginia, since 1960, we have removed 156 spleens because of accidental injury. Of 156 patients, 138 survived for more than one week, and of the 138, six developed subphrenic abscesses.

(Slide) All six subphrenic abscesses developed in patients in whom drains had been placed from 4 to 6 or from 13 to 21 days; patients who had