

Clostridial Infection Following Abdominal Surgery *

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GAS GANGRENE is a dramatic and frequently overwhelming complication of trauma, recognition of which dates back to antiquity. Hippocrates¹ described a gangrenous foot with fulminating toxicity and early death, although he did not mention the presence of crepitation. Fabricus Hildanus, in 1607, is generally credited with a description of the earliest case of emphysematous gas gangrene.¹² Causative organisms were identified in the late nineteenth century when Pasteur, Welch, and Novy, respectively, described *Clostridium Septicum*, *Perfringens*, and *Novyii*.

Although most frequent in traumatic wounds (1.0% all soft tissue wounds in World War I), gas gangrene may also follow elective abdominal operations. In a review of gas gangrene in civilian practice, Millar¹⁰ found 13 per cent of cases followed elective operation. Almost any abdominal operation may be followed by this dread complication but it is most common after biliary and gastro-intestinal procedures.⁶ The high mortality and morbidity rates associated with gas gangrene, particularly when there is delay in diagnosis and proper therapy, prompts the authors to report four instances which followed abdominal operation at the Bronx VA Hospital during the ten-year period ending November 1961. The importance of early diagnosis and methods of therapy are emphasized.

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Case Reports

Case 1. This 69-year-old man was admitted 5-29-57, after increasing constipation and hematochezia of six months duration. X-rays of a barium enema showed a constricting lesion in the distal sigmoid. On 6-5-57 left hemicolectomy with open anastomosis and complementary tube cecostomy was performed for adenocarcinoma of the sigmoid colon. The postoperative course was marked by rapid development of a temperature of 39.4° C. and hypotension of 80/60. On the first postoperative day gangrene was noted developing in the area between the cecostomy and the left paramedian incision for which wide debridement of the anterior abdominal wall was performed. Polyvalent gas gangrene antitoxin, 80 cc. intravenously, every two hours, and 10 million units of penicillin intravenously, were given but to no avail as the patient expired on 6-6-57, 36 hours following operation. Cultures of the anterior abdominal wall grew *E. coli* and *Clostridium perfringens*. The clostridial species was resistant to penicillin and erythromycin.

Comment. The patient did not receive antibiotic bowel preparation. A change in flora produced by the intestinal antibiotics might have prevented this infection. Despite several hours of toxicity, specific therapy was not instituted until after development of gangrene. Of interest is that this Clostridial species was resistant to penicillin emphasizing the necessity for sensitivity studies even though the organism is usually susceptible to penicillin.

Case 2. This 48-year-old man, admitted 9-21-60, had suffered from upper abdominal pain and weight loss for several months. There was occult blood in the stool and there was no free gastric acid. Upper gastro-intestinal x-ray series showed a filling defect in the antral portion of the stomach. On 10-12-60 through a paramedian incision sub-

total gastrectomy and splenectomy were performed for carcinoma of the gastric antrum. On the first postoperative evening fever of 40.3° C. and tachycardia of 120 per minute developed. Suspecting pulmonary atelectasis vigorous tracheal suction was instituted with minimal improvement. On the 4th postoperative day profuse drainage flowed from the RUQ drain site. Smears of this drainage showed large gram positive rods. Clostridia were also recovered on culture of the gastric tube drainage. Therapy immediately instituted was: 10 million units of intravenous penicillin a day, 2.0 Gm. of intravenous Chloramphenicol a day, and 80 cc. of polyvalent gas gangrene antitoxin intravenously every two hours. The wound was opened widely and zinc peroxide dressings were applied. Toxicity was controlled in 36 hours but the local infection progressed through the full thickness of the abdominal wall. A loop of bowel which presented through the dehiscence perforated and on the 9th postoperative day this segment was resected with end-to-end repair. The wound was debrided and closed with through-and-through everting mattress retention sutures. The course thereafter was one of gradual improvement. At discharge, 9 months later, there were several small draining sinuses on the abdominal wall.

Comment. Because of an erroneous belief that pulmonary complication (atelectasis) was the cause of the toxicity 11 hours postoperative, appropriate therapy was not started until attention was directed to the cause of the infection by smear and culture of drainage.

Case 3. This 71-year-old man was admitted after 16 days of RLQ pain and temperature of 39.3° C. There was guarding of the right side of the abdomen with rebound tenderness most marked in the lower quadrant. Bowel sounds were present. Rectal examination, psoas, and obturator signs were negative. There was bulging and edema of the right flank and tenderness in the right groin. Abdominal x-ray films suggested free air on the right lateral decubitus film. Laboratory tests: BUN 25 mg.%, WBC 5,700, hemoglobin 16 Gm. and hematocrit 49 per cent. Shortly after admission, blood pressure fell to 80/70 and the patient was given intravenous Neosynephrine. Following hydration, operation was performed the next day through a right paramedian incision. A paracecal abscess containing fecal and purulent material was found with a large perforation in the wall of the ascending colon. The appendix was normal and tumor could not be identified. The perforated segment was isolated by creation of a

double-barrel ileostomy and loop transverse colostomy and the retroperitoneal space was drained widely. Postoperatively, marked hyponatremia responded to intravenous hypertonic saline and sodium lactate. Atrial fibrillation developed for which the patient was given digitalis. Although immediately postoperative the blood pressure was normal, 20 hours later, shock, fever and tachycardia recurred. In the subsequent 24 hours abscesses developed in both groins and the bulging of the right flank increased with the appearance of crepitation. On 7-30-61 drains were inserted in both sides of the scrotum and the abdominal wall and flank were debrided widely. Despite zinc peroxide dressings, blood transfusions, gas gangrene antitoxin, massive antibiotics and intravenous neosynephrine, death occurred on 8-1-61. Between the evening before and the morning of death, hemoglobin fell from 11.4 to 6.4 Gm. Urinary urobilinogen was elevated and the serum bilirubin was 2.8 mg.%. Cultures taken during both operations showed multiple organisms including *Clostridium perfringens*.

Comment. It can be postulated that gas gangrene infection was present from admission until death. The initial abdominal x-ray films may have shown emphysematous cellulitis rather than free air. Two points are demonstrated in this case, 1) crepitation often is a sign of late and profound toxicity; and 2) severe hemolysis, which is a frequent concomitant of Clostridial infection, may be extremely rapid, must be anticipated and vigorously treated.

Case 4. This 71-year-old man, admitted 7-6-61, had a subtotal gastrectomy in March, 1958. On 7-15-61 a symptomatic hiatal hernia was repaired through an abdominal incision. Ten days postoperatively upper intestinal obstruction developed which persisted despite repeated efforts at nonoperative management. On the 41st postoperative day, at laparotomy, dense adhesive bands were found obstructing the efferent loop. In the process of separation, a loop of small intestine was accidentally perforated and then closed in two layers. The abdomen was repaired in layers and retention sutures were added. That evening the patient became hypotensive with tachycardia and temperature elevation to 39.4° C. X-rays and clinical observation suggested pulmonary atelectasis. Bronchoscopy was performed without improvement. Twenty hours later, because of persistent toxicity and although the wound appeared normal, several skin sutures were

removed and smears were taken which showed gram positive rods. Subsequently Clostridia were cultured from the wound as well as from the gastric tube drainage. Hydrogen peroxide was infused into the wound which was packed open between retention sutures. Penicillin and chloramphenicol were administered. Polyvalent gas gangrene antitoxin (80 cc.) was given intravenously every two hours. Intravenous neosynephrine and cortisone were required to maintain blood pressure levels. Within 48 hours the patient's status markedly improved. During the next several days intensive local debridement was done until the wound was sufficiently clean to permit covering with a split thickness skin graft. The patient gradually improved and was discharged in six months.

Comment. Eight hours postoperative this patient had fever of 39.4° C. and 14 hours later, hypotension. There were no other signs to suggest gas gangrene infection. Because of the fulminating toxic course smears of the wound were examined and led to the correct diagnosis so that specific therapy was instituted 20 hour postoperatively. Retention sutures permitted opening of the wound through the anterior sheath, packing between sutures and debridement of the rectus muscle without evisceration.

Discussion

Clostridial organisms frequently inhabit the alimentary tract and are readily recovered from the feces.¹² Andrews and Henry,³ and Thorseness¹³ found positive cultures for Clostridia in from 7.0 to 11 per cent of human gallbladders and gallbladder bile. Jennings⁷ cultured *Clostridium Welchii* in 90 per cent of acutely inflamed appendices. Yet clinical infection is an uncommon occurrence. In an extensive collective review Altemeier and Furste¹ have described prerequisites for gas gangrene infection, and have outlined the syndromes produced. Compound fractures, wounds with devitalized muscles, and tissues in areas of major vascular injuries are most frequently associated with the occurrence of the disease. The anaerobic nature of the organisms is another major factor responsible for the

uncommon occurrence of gas gangrene. Synergistic bacteria may favor the growth of Clostridia by lowering the oxygen tension.¹¹

Clostridial infection as described by Altemeier and Furste¹ may present as either a cellulitis or myositis. The myositis need not be emphysematous and may be localized or spreading. Lindsey's work has shown that obvious crepitation need not occur until toxemia is profound.

The diagnosis of clostridial infection should be considered in a postoperative patient who presents a picture of toxemia. Altemeier describes the typical patient: pale, perspiring, weak, with a feeble rapid pulse, complaining of severe pain. A tachycardia out of proportion to the fever could be the earliest indication of toxemia and in the postoperative patient may be the only sign. Inspection of the wound and drainage sites may yield early evidence of infection. The characteristic foul odor or a profuse watery discharge should lead the observer to suspect anaerobic infection. It is possible that one or two skin sutures may have to be removed and the wound spread to find this watery brown drainage. These signs should indicate the need for a gram stain, and if large gram positive bacilli are present anaerobic cultures should be inoculated. Therapy should not await the results of culture. Treatment must be instituted as early as possible to be successful. It is better to initiate therapy and discontinue it later than to waste precious hours awaiting laboratory tests.

Therapy must be individualized. In clostridial infection of an extremity extensive debridement or radical amputation may be life-saving measures. But when the process attacks the abdominal wall in the immediate postoperative period debridement may have to be limited. The presence or absence of retention sutures may have a vital bearing on the outcome. The wound must be opened, necrotic tissue removed.

and necessary additional incisions made to insure adequate drainage. In the absence of retention sutures perhaps re-opening the entire wound, performing an extensive debridement, and then closing the wound with everting interrupted through-and-through mattress sutures might be life saving. The delivery of a high concentration of oxygen to the affected area may be of extreme importance. Zinc peroxide, as described by Meleney,⁹ was used in one of our successful cases but this requires much previous preparation and is associated with tedious intermittent dressing changes. More recently, we have used successfully a continuous hydrogen peroxide infusion in the wound aspirating excess fluid by means of a sump catheter in the lower angle. There is experimental and clinical evidence that high atmosphere pressure chambers with pure oxygen for respiration may have a beneficial effect on anaerobic infections.^{4, 5}

Antibiotics in massive parenteral dosages must be instituted combined with gas gangrene multivalent antitoxin in high dosages repeated at two- to six-hour intervals until the infection is under control. Equally as vital in the care of these patients is careful supportive therapy. Fluid and electrolyte imbalance is common with this infection. The hemolytic effect of clostridial toxins is well known and must be anticipated and corrected with repeated blood transfusions. Often vasopressor agents will be needed to maintain adequate blood pressure levels. Cortisone may also be necessary in these patients and should be given with the vasopressors when and if vital signs are unstable.

Summary

Four cases of gas gangrene infection following abdominal operation are presented

and discussed. Early diagnosis is essential if the patient is to survive. This may require separation of the edges of a normal appearing wound to obtain smears and cultures. Methods of local and systemic therapy are suggested.

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