Incarceration of Existing Inguinal Hernia as a Complication of Pulmonary Function Testing*

Vendana Patel, M.D.; Lina Raju, M.D., F.C.C.P.; and Christine Wollschlager, M.D., F.C.C.P.

Pulmonary function testing (PFT) has not been listed as a risk for development of incarceration in an existing inguinal hernia. We report two patients who developed this complication after routine preoperative PFT. We also present data of our retrospective review of eight patients with inguinal hernia who were referred for preoperative PFT. Two out of eight patients suffered incarceration of an existing inguinal hernia. We found no significant difference in mean age, weight, smoking habits, number of forced expiratory maneuvers, time of sustained forced expiratory maneuvers, or any PFT data between the groups with and without incarceration. Thus, incarceration of inguinal hernia could not have been predicted prior to PFT and was not related to other factors such as obesity or more severe airway obstruction.

(Pulmonary Function Testing (Patel, Raju, Wollschlager) 1992; 101:876-77)

Preoperative pulmonary function testing (PFT) is an integral part of preparing many patients for surgery. The goal is to identify patients at increased risk of perioperative morbidity and mortality. Indications for preoperative PFT include patients with a history of smoking, chronic cough or dyspnea, age over 70 years, known pulmonary disease, obesity, previous history of postoperative complications, and proposed thoracic or upper abdominal surgery. Forced expiratory spirometry, arterial blood gas value analysis, and regional lung function assessment are the tests most commonly performed in this setting. Forced expiratory spirometry is a relatively simple procedure with almost no associated complications. Review of the literature fails to show any definite listed complications or contraindications for spirometry. Conceivably, patients with recent acute myocardial infarction, superior vena cava syndrome, pneumothorax, or hemothysis could be at increased risk for complications during PFT. We encountered two patients with inguinal hernia who were referred to our pulmonary laboratory for preoperative FFT and who subsequently suffered incarceration of their existing reducible hernias. This report describes these two cases and our retrospective review of inguinal hernia patients referred to our laboratory for PFT. We attempted to identify predisposing factors which could lead to incarceration, and to elucidate possible mechanisms for this complication.

Case Reports

Patient 1

A 63-year-old white man was admitted to the surgical service with the chief complaints of right-sided lower abdominal pain and swelling of one week's duration. He gave a history of asthma, cigarette smoking (two to three packs per day for 30 years), chronic cough, and left inguinal herniorrhaphy in 1969. Physical examination was unremarkable except for expiratory wheezes bilaterally and an easily reducible right inguinal hernia. Four hours after the patient performed preoperative spirometry, he developed unbearable pain in the right groin area. The hernia was nonreducible despite sedation. Emergent surgery was performed because of the possibility of incarceration. At surgery, a large hernia sac containing blood-tinted fluid and a loop of viable bowel was found. The patient tolerated the procedure, had an uncomplicated postoperative course, and was discharged on the fifth postoperative day.

Patient 2

An 80-year-old man with a history of right inguinal hernia for more than one year came to the emergency room with complaints of pain and swelling in the right groin area. Physical examination was unremarkable except for a nontender reducible right inguinal hernia. The patient was referred for preoperative PFT. During spirometry, the patient complained of abdominal pain but was able to perform the forced expiratory maneuvers without difficulty. Two hours later he was found to have an irreducible hernia and was taken to the operating room for surgery. Operative findings revealed a large hernia sac containing viable-appearing bowel. The hernia was repaired and the patient had an uncomplicated postoperative course. He was discharged on the fourth postoperative day.

Retrospective Study

We retrospectively reviewed the records of all eight patients with inguinal hernia referred to our PFT laboratory for preoperative spirometry between July 1988 and July 1989. We defined two groups of patients: group 1 included six men who did not suffer hernia incarceration, and group 2 included the two men just described as patients 1 and 2. On comparison between the two groups, we did not find any statistically significant differences in the following parameters: age (50 ± 12 vs 71 ± 12 years); height (81.18 ± 83 ± 8 kg); smoking habits (5/6 vs 2/2 patients were smokers); number of forced expiratory maneuvers (8 ± 1 vs 7 ± 1); average duration of forced expiratory maneuvers (11.6 ± 1.3 vs 12.3 ± 0.4s); FVC (75 ± 20 vs 83 ± 50 percent of predicted); FEV1,
(65 ± 9 vs 58 ± 7 percent of predicted); and maximum voluntary ventilation (73 ± 24 vs 74 ± 65 percent of predicted).

**Discussion**

Inguinal herniation is a common medical problem estimated to affect 5 percent of the total adult population. Inguinal hernia may result from a congenital anatomic defect in the muscular support of the inguinal canal or may be acquired by trauma later in life. Increased intra-abdominal pressure, chronic cough, straining at lifting, Valsalva maneuver, and diseases of the genitourinary tract and gastrointestinal tract predispose to hernia formation. Once formed, the risks include incarceration or strangulation of an intraperitoneal organ within the hernia sac. The development of complications in a hernia is not predictable. When complications do occur, an elective situation becomes an emergency, as in the cases reported. Pulmonary function testing is not listed as a risk for development of incarceration of an existing hernia. We encountered two patients who suffered incarceration of their hernias immediately after routine preoperative PFT; however, we could not find any clinical or physiologic criteria that could predict incarceration when we compared them with patients who did not have incarcerated hernias. We believe that incarceration was produced during PFT by generation of a prolonged increase in intra-abdominal pressure. A forced expiratory maneuver is similar to a cough and involves the expiratory muscles of the chest and abdominal wall. Although the maximum transpulmonary pressures generated during coughs are higher than those generated during forced exhalation, these high pressures are sustained for a longer period of time during forced exhalation. A sustained contraction of the muscles of the abdominal wall, as could be expected with a forced expiratory maneuver, may be more effective than a cough as a factor precipitating this complication. Experiments designed to measure intra-abdominal pressures during cough have consistently shown increased intra-abdominal pressures. One could extrapolate similar changes in intra-abdominal pressures during forced exhalation. The resultant increased abdominal pressure would push the contents of the hernia sac outward through the inguinal ring, leading to incarceration. It is possible that incarceration of hernias after PFT is more frequent than expected and its temporal relationship to PFT should be noted. In conclusion, we believe that (1) incarceration of an existing inguinal hernia is a risk of PFT, (2) clinical and PFT data do not delineate which patient will suffer hernia incarceration and (3) possible prevention of this complication by use of a truss support to hold the abdominal contents within the abdominal cavity should be considered in male patients with hernias when PFT is being performed.

**References**


**Bowel Infarction as the Initial Manifestation of Disseminated Aspergillosis**

Rubin Cohen, M.D.; and John E. Heffner, M.D., F.C.C.P.

Disseminated aspergillosis in the immunocompromised patient most commonly presents with clinically apparent pulmonary involvement and roentgenographic infiltrates. We report a patient with acute myelogenous leukemia who developed bowel infarction due to gastrointestinal invasion of *Aspergillus fumigatus* as the initial manifestation of widespread fungal disease. (Chest 1992; 101:877-79)

Disseminated aspergillosis is a rapidly progressive and highly lethal infection in patients with altered host defenses resulting from such conditions as hematologic malignancies and immunosuppressive therapy. Although Aspergillus species can invade the gastrointestinal tract, patients with bowel involvement in the setting of disseminated disease have been reported to invariably present with coexisting, clinically predominant lesions in other organs, which almost always include the lung. We report a patient with acute myelogenous leukemia and drug-induced granulocytopenia who developed intestinal infarction as the initial organ manifestation of disseminated aspergillosis before the onset of pulmonary symptoms or chest roentgenographic abnormalities.

**Case Report**

A 33-year-old man with acute myelogenous leukemia underwent induction therapy with cytosine arabinoside and daunomycin. Ten days later, the patient developed a fever with a temperature of 39.8°C and pancytopenia with a granulocyte count of 200 cells/μl. The physical examination was unremarkable and a chest roentgenogram was normal. Blood and sputum cultures were negative. Therapy was initiated with amikacin and ceftazidime, and when fevers persisted three days later, therapy with amphotericin B and vancomycin was started. Three days later, the patient became afebrile but developed a generalized maculopapular rash that prompted the discontinuation of all antibiotics. Treatment with fluconazole was started in consideration of the patient's apparent response to amphotericin B.

The patient remained well until one week later when fever (39.7°C) recurred during a second course of therapy with cytosine arabinoside and daunomycin. A chest roentgenogram remained normal and blood and sputum cultures were negative. Amikacin and vancomycin were started with resolution of febrile episodes two days later. During a third course of chemotherapy while still receiving antibiotics, however, the patient developed a fever with a temperature of 40°C associated with watery diarrhea (2,000 ml/day) and mild abdominal discomfort. The abdominal physical examination revealed mild tenderness without signs of peritonitis, and chest roentgenograms disclosed no abnormalities. Stool fungal and bacterial cultures and *Clostridium difficile* toxin assays were negative. Two days later, the patient developed more severe abdominal pain with signs of peritonitis and underwent an exploratory laparotomy that demonstrated a 10-cm length of necrotic distal ileum and a...