Before that, Ambroise Paré (1598) and Joseph-Pierre De-Arnoult asserted the mechanical nature of strangulation. Beside empyema, the most serious of all complications even today. I have seen huge hernias, which are natural complications, and recurrent hernias, which are the complications of suboptimal repairs. In this article, I will discuss some alternatives for surgeons, technical considerations, and in adults only. Recurrent hernias are also considered complicated by failed treatment.

### Treatment of Complicated Groin and Incisional Hernias

E. Stoppa, M.D.
Department of Clinical Surgery, Faculty de Medicine d’Amiens, C.H.U. d’Amiens, Amiens, France

Hundred years ago, Edoardo Bassini said: "L’ernia e una malattia meshica." Before that, Ambroise Paré (1598) and Joseph-Pierre De-Arnoult asserted the mechanical nature of strangulation. Beside empyema, the most serious of all complications even today. I have seen huge hernias, which are natural complications, and recurrent hernias, which are the complications of suboptimal repairs. In this article, I will discuss some alternatives for surgeons, technical considerations, and in adults only. Recurrent hernias are also considered complicated by failed treatment.

In medical literature offers only a few articles on this topic, of which are the reports by Nyhus and Condon [1] and by [2], although the overall frequency of complicated hernias represents a large number of patients in current surgical series [3].

**Complicated Groin Hernias**

*Voluminous Groin Hernias*

When a groin hernia exceeds the volume of a fist, it is no longer tolerated. Eighty-eight percent of voluminous groin hernias are indirect inguinal hernias. Overstretching of the inguinal canal results in a loss of substance in the deep inguinal wall such that the 2 inguinal orifices are enlarged and displaced at the same time. As the normal oblique line of the canal disappears, a large visceral mass, often having lost its right of domain in the abdomen, passes through the wide defect in the abdominal wall.

These hernias, naturally complicated, are no longer benign for the following reasons. First, their large volume causes serious surgical difficulties. Second, coexisting problems may be the advanced age, poor general condition, obesity, or cachexia of the patient. Third, repair of a large hernial defect does not inspire confidence. Fourth, the intestinal contents, more or less adherent or sliding and more or less reducible, are affected by circulatory changes. Fifth, the much-modified scrotal envelopes are the cause of difficulties during the hernial repair and postoperative healing.

Huge hernias are a serious disability because of the volume and weight of the scrotum, the cardiorespiratory consequences, and the effect on intestinal function. A carefully made surgical decision thus becomes imperative. Voluminous groin hernias illustrate the advantages of the surgical treatment of hernias while they are still benign.

A 22.7% frequency of voluminous groin hernia was found in our multicenter study [5] for the Association Francaise de Chirurgie (AFC). The incidence was 14.1% in an individual series [6] in which right hernias occurred as often as left ones. The distribution by sex was 20% of the total in men and 9.3% of the hernias in women.

**Treatment.** When performing a repair by the inguinal approach, I emphasize the necessity of preparing the patient carefully. When a huge hernia is to be repaired, I recommend the use of Goni Moreno’s progressive pneumoperitoneum [7, see also article by Raynor and del Guercio in this symposium] accompanied by ventilatory physiotherapy. In addition to its favorable ventilatory action, progressive preoperative pneumoperitoneum can stretch sacular adhesions and allow herniated viscera to reduce.

Of interest is that Piedad and associates [8] found that the clinical diagnosis of sliding contents is made in only 20% of patients. In these patients, I use a giant bilateral retroperitoneal polyester mesh prosthesis placed by a midline subumbilical approach, according to an original technique that my associates and I developed [9-16]. This is a simple, reliable, and safe
Fig. 1. Schematic horizontal section showing the position of a giant bilateral prosthesis (dotted line) placed by a midline subumbilical approach into the preperitoneal space to repair a groin hernia.

Fig. 2. Schematic of a giant bilateral retroparietal prosthesis used in the repair of a groin hernia. Note its correspondence with the subumbilical regional landmarks—the 2 inguinal canals and the pelvic swells. Insert, the chevron-shaped prosthesis.

Some technical considerations are as follows: (a) In obese patients, a Trendelenburg position helps to reduce the hernial contents, (b) When the hernial contents adhere to the sac, their dissection and reduction are greatly simplified when they are freed by a separate inguinal incision, (c) If voluminous sliding has occurred, one must dissect the sac and its contents together and reduce them into the abdomen without freeing the natural visceral adhesions.

Results. The following are data from a personal series of 230 voluminous groin hernias among a total of 1,628 groin hernias. Twenty-five percent of the patients were older than 60 years of age. Voluminous groin hernias constituted 20% of all hernias in men and 9.3% of the hernias in women. The rate of bilateral voluminous groin hernia was 42.2% versus 36.6% of the total number of groin hernias. The recurrence rates in other studies, in which giant prostheses were not used, were 27.5% for voluminous groin hernias and 20% for all groin hernias. The rate for a simple postoperative course was 81.9% for voluminous groin hernias and 91.3% for all groin hernias. The postoperative mortalities after the use of 4 different techniques were 2.4% for voluminous groin hernias and 0.7% for all groin hernias. Control of the hernias was achieved in more than 75% of patients 2–10 years after treatment. Interesting findings were that there was no testicular atrophy (because the scrotal sac had not been dissected), there was little sequelar pain, and there was a 3.4% recurrence rate versus less than 1% for all groin hernias repaired by giant prostheses placed by the subumbilical midline approach. This prosthetic repair resolves the difficulties encountered in classic repairs of voluminous groin hernias, such as loss of fascial substance or sliding, and has fewer sequelae and recurrences (the rate of which was 25% after the Bassini...
Strangulating Groin Hernias

Strangulation is the most serious complication of hernias. The treatment of strangulating groin hernias does not seem to have profited from either recent surgical advances or the progress of medical management of hernias. The mortalities have not changed much for the last 40 years, although strangulating groin hernias are still a frequent cause of acute abdomen.

The incidence of strangulating groin hernias was 8.7% of groin hernias in the AFC series [5], 8.9% in my associates' and my records [16], and 12.3% in the report of Flament and coworkers [17]. Femoral strangulations are more frequent than inguinal ones (28.2% versus 4.3% according to Hjaltason [18]), although the total number of strangulating inguinal hernias becomes higher as the absolute frequency intervenes. A breakdown of the series of Flament and coworkers [17] shows a 46.4% incidence of strangulated inguinal and a 53.6% incidence of strangulated femoral hernias.

Again, the numbers of male and female patients are almost equal, but the breakdown by anatomic types is different when the sex ratio is considered. In Hjaltason's series [18], the male-to-female ratio was 5:1 for inguinal hernias and 1:7 for femoral hernias. In the series of Flament and coworkers [17], the ratio was 6:1 for inguinal hernias and less than 3:1 for femoral hernias.

Two of 3 patients were older than 65 years of age in Hjaltason's [18] series. The mean age of the patients was 69.2 years for strangulating groin hernias and 58.4 years for all groin hernias. In the series of Flament and coworkers [17], the mean age of the patients was 72.3 years for femoral hernias and 65.8 years for inguinal hernias.

There is nothing new about the diagnosis of strangulating groin hernias. A history of the accident and a careful clinical examination tell more than roentgenograms of the abdomen in unknown hernias. The diagnosis is usually easier in strangulating inguinal hernias than in femoral ones. Most of the patients with inguinal hernias in Hjaltason's [18] series had correctly identified their accident, but only one half of patients suffering strangulating femoral hernias complained of abnormalities in the inguinal region. In the latter patients, examination in an upright position as propounded by Dennis and Enquist [19] has not been consistently efficient. In Hjaltason's [18] series, 22% of strangulating groin hernias were recurrent. Twenty-five percent of the other patients had had a contralateral hernial repair, and several patients had undergone previous taxis for incarceration of the hernia, 1 patient as often as 11 times. Right inguinal hernias strangulate more often than left ones. Champault and associates [20] reported a prevalence of right femoral hernias as well.

The relation between mortality and length of preoperative evolution or age is understandable, poor risk being related to both intestinal necrosis and systemic complications of more dubious control in emergency circumstances [21]. In the series of Flament and coworkers [17], Hjaltason [18], and Champault and associates [20], the most frequently strangulated viscera were, in decreasing frequency, small intestine, omentum, colon, and bladder.

Two rare strangulations that are difficult to diagnose are Richter hernia and Littre hernia. In Richter hernia, less than the full circumference of the intestine herniates, with variable or absent obstructive symptoms and poor local signs. In Littre hernia, which involves the congenital Meckel diverticulum [22], patients are frequently operated on when hernial phlegmon or an enteric fistula has appeared. Partial resection of the intestine is then often possible by a local approach, but the hernial repair is compromised by sepsis.

Symptomatic hernias must be distinguished from strangulating groin hernias. Every surgeon has seen hernias that become painful when intraabdominal diseases occur, such as acute appendicitis, cholecystitis, or peritoneal carcinomatosis with ascites. I agree, however, with Dennis and Enquist [19], who recommended not distinguishing between incarceration and strangulating groin hernias and who choose emergency surgical exploration in confusing situations. I am impressed by the too frequently delayed operations for strangulating groin hernias. Flament and coworkers [17] state that only 4 of 5 strangulating groin hernias were operated on within 12 hours of detection, whereas 1 of 5 hernias operated on 24 hours or more after detection were treated by intestinal resection. Champault and associates [20] specified that fewer than 1 of 4 strangulating femoral hernias were operated on within 12 hours of detection, more than 1 of 4 between 24 and 48 hours, and 1 of 10 more than 2 days after detection. Thus, almost 1 in 4 patients has undergone an intestinal resection.

I advise against attempts at taxis in patients who are seen early. There are 2 reasons for this decision—the exact time of strangulation is difficult to determine mostly for femoral hernias and in elderly patients, and the risk of worsening ischemic lesions or of reductio en masse seems to be too dangerous. Thus, surprisingly, in Hjaltason's series [18], 1 patient in 2 had a successful attempt at taxis in a little more than 1 attempt in 10, mostly for inguinal hernias. There were few attempts at taxis of femoral hernias. One must note that, after successful reduction, patients underwent operations on the second or third day following, or immediately, when reduction was impossible. There was a 22% rate of intestinal necrosis.

Treatment. An emergency does not exempt a surgeon from ordering the usual preoperative laboratory examinations or from taking the necessary preoperative precautions. The choice of anesthesia takes into account general risk; local anesthesia is better for patients at high risk.

A direct incision should be made no matter what the type of hernia. If necessary, a midline laparotomy is preferable to a herniolaparotomy. A hernial phlegmon is an elective indication for a midline incision for an aseptic initial attempt, followed by en bloc resection of the incarcerated loop by an inguinal approach.

I recommend opening the skin on the principal axis of the hernial bulge, a more vertical orientation than is used for a standard repair. The primary technical considerations are: dissection and prudent opening of the sac, careful incision of the strangulating neck avoiding injury to the inferior epigastric vessels and conjoint arch, and evaluation of intrasacular structures, most often the intestine for viability, for adequate treatment. After the sac is treated, repair of the wall is done by a simply herniorrhaphy because of the septic risk encountered in
emergency operations. The original Bassini operation is used for inguinal hernias and the McVay operations for femoral hernias. We advise against the use of nonabsorbable prostheses. Polyglactin mesh can be used in the presence of sepsis, but the results are not guaranteed. One must remember the septic nature of the intrasacular fluid and use rapid suction and careful protection of the wall and subcutaneous tissues.

The operation does have some surprises and pitfalls. Strangulated ovaries and uterine tubes must be tentatively preserved. An ectopic testis, however, must often be sacrificed because of the shortness of the cord. It is preferable not to replace the diseased gonad into the abdomen, even if it is viable. An inflammatory or gangrenous appendix is resected. When pus exudes from the abdomen, a herniorrhaphy is not necessary; the sac can be drained and a midline incision made for the treatment of the peritonitis. A Meckel diverticulum (Littre hernia) is resected and its junction with the ileum sutured. A diverticulum of the bladder must be saved and, if possible, buried in the bladder. Maydl hernias, in which the intestine forms a "W," necessitate special attention to the intraabdominal intermediate loop, which may be more ischemic than an intrasacular loop. When control is difficult, one should not hesitate to perform a laparotomy. In strangulating sliding hernias, I suggest that one control the viscera, which are often still viable, then close the sac before reduction, which is simplified by the presence of perisacular edema. Repair of the large hernial orifice is, thus, made possible, if not guaranteed.

The indications for intestinal resection must be grave because the reduction of dubious loops exposes the intestine to secondary perforation, adhesions, or stenosis. There is no magic test of intestinal viability. It must be emphasized again and again that the intestine must be reduced if healthy and resected if not, whatever the patient's condition. When a midline incision is used, one may relieve the distention of the intestine by gently pressing its contents back to the stomach.

Results. Poor results of the surgical treatment of strangulating groin hernias still demonstrate the negative effect of advanced patient age and intestinal resection. The overall mortality was 17% for inguinal and 33% for femoral hernias in the series of Dennis and Enquist [19]. It was 9.7% for strangulating groin hernias in Hjalton's report [18] and 12.3% in the series of Flament and coworkers [17]. The mortality for resection was 21% in contrast to 8% for treatment involving no resection in the series of Dennis and Enquist [19] and 40% for resection as opposed to 5.2% for treatment involving no resection in the series of Flament and coworkers [17]. In my associates and my series [16], the mortality was 9% for strangulating groin hernias and 66% for phlegmons. Champault and associates [20] reported a 7.5% mortality for femoral strangulating hernias.

The treatment of strangulating groin hernias is becoming a serious gerontologic problem. The problem can be solved by a timely operation after appropriate preparation.

Contused Groin Hernias

The diagnosis of this complication, which is brought about by inappropriate use of a truss, is sometimes not easy. When the diagnosis is made, usually in voluminous hernias, urgent surgical intervention is required. Traumatic lesions may involve the contents (hematoma or rupture of the intestine or omental mesenteric lacerations), the covering, or the spermatic cord. These lesions can either simulate a strangulation or be latent until peritonitis appears. Laparotomy is recommended routinely for the control and treatment of the lesions [23, 24].

Recurrent Groin Hernias

Recurrent groin hernias expose a patient to the complications of all groin hernias. At the same time, they are more difficult and hazardous to repair.

The frequency of recurrent groin hernias observed in global series of groin hernia varied from 10% [25, 26] through 12% [27] and 18% [6], and from 20% [28] to 30% [29, 30]. During long postoperative follow-up studies (of well-known differences in complexity of procedures), the recurrence rates were less than 1% in a Shouldice series [26] and after Stoppa's giant prosthetic repair [16], 3.5% in McVay's series [31], 6.8% after 3 years of control in Marsden's series [32], and 8.6% after 10 years in the series of Palumbo and Shape [33]. It is known that the skill and the specialization of surgeons lower recurrence rates. The Shouldice series [34] demonstrate this concept. The recurrence rates at that hospital were 18.8% in 1945, 12% in 1946, 6% in 1947, 3% in 1948, and less than 1% since 1951. In my associates', and my series, the recurrence rates for giant prosthetic repairs by the abdominal approach were 3.3% in 1974, 1.2% in 1983, and 0.56% in 1986.

The time to recurrence varies; it has been as long as 25 years [34]. In my review of multiple techniques of repair, 5.6% of recurrences appeared during the first postoperative month, 39.1% during the first year, and 23.5% after the tenth year. After prosthetic repair, recurrences take place during the first postoperative year and are associated with incorrect technique; after herniorrhaphy, they are dispersed over a long postoperative period, associating incorrect technique with worsening of results. Halverson and McVay [35] proposed a formula for determining the predictable recurrence rate at the 25th year by multiplying the first-year recurrence rate by 5, the second-year rate by 2.5, the fifth-year rate by 1.5, and the tenth-year rate by 1.2.

Among 459 recurrent groin hernias reported by the Shouldice Hospital [26], 60% were inguinal hernias and 40% were femoral hernias. Femoral hernias recurred most often (2.2% in men, 1.3% in women) and sliding hernias were second (1%). In the AFC inquiry [5], femoral hernias recurred most often (8.2%) followed by inguinal evinations (7.9%). Some authors have shown a higher recurrence rate after operations for recurrences. One initial recurrence rate was 7%, and these hernias recurred in 19% of the patients after the recurrence was treated [32]. Clear [36] reported a failure rate of 39% for repairs of recurrent hernias. Thus, recurrences must be considered as new lesions, partially produced by previous operations. The preferable treatment is with a prosthesis. This recommendation has been upheld by surgeons at the Shouldice Hospital [37] facing with recurrent femoral hernias.

The mechanisms of recurrence after a repair are difficult to identify when the recurrence is late and when the previous operation has been performed at another hospital. Even during the reoperation, the previously used procedure is often not identifiable. Houdard and I [5] classified recurrence factors into...
incorrect technique, a large hernial defect, and miscellaneous factors.

Incorrect technique is responsible for most recurrences during the first postoperative year. Examples include not dissecting or not finding a sac [26], leaving too long a peritoneal stump [38], incorrect closure of the hernial orifice, as demonstrated by the frequency of indirect recurrences, and suture under tension, which is most involved in direct recurrences [39]. Some techniques are more likely than others to lead to a recurrence. These include totally pre- or retrofunicular repairs and procedures using the Cooper ligament without a McVay transition suture on the vessel sheath.

Large hernias recur twice as often as small ones, and careless management results in a recurrence. Extended dissection or traumatic sutures may change a contractible inguinal wall into a fibrous wall exposed to progressive rupture [40].

Other risk factors, independent of the quality of the operation, are the patient's general condition and age, abdominal wall weakness, and obesity [41]. The most dangerous factors are postoperative sepsis and chronic cough. Early activity or return to work is no longer blamed for recurrences. Eighty percent of recurrent hernias are independent of heavy work [38]. Persons with sedentary occupations suffer more recurrences (17.6%) than those performing heavy labor (9.1%) [39]. Marsden [32], Rives and Hibon [4], and Houdard and associates [42] support that finding. In Warlaumont's series [6], 56% of recurrences appeared in the absence of any effort and only 15% after extreme exertion.

Recurrences after prosthetic repair result exclusively from technical mistakes and, thus, appear during the first postoperative year. In our series, no recurrences appeared after the end of the first year. During the postoperative course, serohematoma must be distinguished from recurrent hernias. The classic clinical signs can be confirmed by echography. Recurrences that take place after placement of a giant prosthesis through a midline subumbilical approach are usually caused by insufficient size or displacement of the prosthesis. Slitting a prosthesis to let the cord pass through predisposes it to breakage, so we prefer to avoid the risk by walling-off the cord components [13-16].

Treatment. To repair a recurrent inguinal hernia, the surgeon has to choose between an inguinal incision or a preperitoneal approach. The inguinal route requires a larger incision [43]. Local anesthesia can be used, and the Poupart and Cooper ligaments are often intact, but one has to be prepared for a more or less difficult dissection, a certain risk of injury to the cord (a factor in sequela testicular atrophy), and a possible regional nerve lesion. When damaged inguinal structures are exposed, a prosthesis can be used, but there are more difficulties than with the preperitoneal approach.

The preperitoneal approach for the placement of a giant polyester mesh prosthesis is a simple operation in which the surgeon progresses through normal, unmodified anatomy and cannot miss any other hernia. It is almost an absolute weapon against recurrence, but sepsis must be relieved, and preparation must be made for a mandatory aseptic operation. For recurrent groin hernias, I routinely use a bilateral giant prosthesis of polyester mesh, widely interposed between the peritoneum and the abdominal wall (Figs. 1, 2). Through Pascal's hydrostatic principle, intraabdominal pressure (the force that provoked the hernia) is used to eliminate recurrence. Because of its large dimensions, the giant prosthesis is instantly and definitively set in place and does not require any direct fixation. Walling-off the cord components makes it unnecessary to slit the prosthesis for their passage through it, allowing the operation to be simple and safe. This original personal technique has been discussed in numerous publications [10-16]. Thorough training and understanding of the procedure are recommended before it is undertaken.

Recurrences after placement of a prosthesis placed by an inguinal approach may be indirect or direct caused by partial breakage of the prosthesis fixation stitches. A preperitoneal approach is preferable for easy retroperitoneal separation and for the placement of a preperitoneal prosthesis. Recurrences after placement of a giant prosthesis by the preperitoneal route are related to insufficient size, slitting the mesh, or not spreading it far enough. When the recurrent hernia is lateral, a suprainguinal incision, as described by Nyhus, can be used to place another piece of mesh laterally to complement the previously placed prosthesis. For a central or inferior recurrence, an inguinal incision allows the surgeon to find the inferior border of the prosthesis and fix it to the Cooper ligament.

Results. In a personal series of 349 recurrent groin hernias (15.7% of patients treated for groin hernias), the bilaterality rate was 42.2%. Four techniques were used: the Bassini operation in 2 patients (6.6%), Cooper ligament repair in 30 patients (8.6%), prosthesis insertion by the inguinal route in 39 patients (11.2%), and placement of a giant prostheses through a midline incision in 270 patients (77.4%). An excellent postoperative course was observed after both Bassini operations, after 28 Cooper ligament repairs, after 21 inguinal prosthesis placements (79.5%), and after 261 placements of giant prostheses by the midline approach (96.7%). Hematomas occurred after 2 Cooper ligament repairs and 9 placements of giant prostheses (3.3%). Sepsis occurred after 6.6% of the Cooper ligament repairs, after 7.7% of the inguinal prostheses were placed, and after 3% of the giant prostheses were placed (no prosthesis was removed, and all patients healed). One recurrence took place in a Bassini operation, 5 after a Cooper ligament repair, 4 after inguinal placement of prostheses (10.3%), and 3 after placement of giant prostheses by the midline approach (1.1%). Thus, in our experience, the placement of giant prostheses by the midline approach to treat recurrent or rerecurrent hernias has less morbidity and better results than other techniques.

Complicated Incisional Hernias

Large Incisional Hernias

Large incisional hernias are those that are 10 cm or larger in diameter at the rim. The incidence of such hernias was 28.5% among 466 patients in my series. These hernias present difficult problems for a surgeon related to direct protrusion of the contents through a large parietal defect and development of regional disorders that affect not only the muscular wall and the skin but also the respiratory mechanism and other functions. It is impossible to treat only the mechanical aspect of the entervation (reduction of the visceral contents into the abdomen and
closure of the parietal defect) without considering the associated major disorders.

Rives and associates [44, 45] emphasized the trophic changes of the skin in large incisional hernias, which culminate when a dystrophic ulceration appears at the top of the bulge. Histologic findings confirm the trophic mechanism of the lesion by capillary thrombosis. Because the risk of infection of the ulcer is high, the surgeon must treat the skin lesion before undertaking the hernial repair. Obesity often causes an apron-like cutaneous fold that is subject to dermatosis.

Median large incisional hernias constitute a disinsertion of the lateral belt muscles, whose fibers pass around the rectus abdominis muscle to reach the midline. Thus, lateral muscles retract and atrophy, as evidenced by histologic and electromyographic disorders.

Distinct muscular lesions occur in 3 areas of the abdominal wall based on the disposition and length of muscular fibers: a superior area (chondrocostal insertions), where fibers are short and contractility can be preserved; a median area (spinal insertions), where fibers are long and contractility is partially preserved; and an inferior area (inguinal regions and the linea arcuata of Douglas), which is a weak zone.

Factors that induce enlargement of large incisional hernias are the intraabdominal pressure, as in all hernias, and medial disinsertion of the fibers, a progressive disruption. Because of these 2 factors, the collars of large incisional hernias take a circular shape and their diameters increase with time. Muscular lesions depend on the location of the large incisional hernia. Because their peripheral extremities degenerate, lateral lesions are more severe when muscular fibers have been cut. In peripheral lesions with a chondrocostal, iliac, or pubic edge, fibers are destroyed and contractility cannot be preserved.

The large defect and the visceral protrusion are responsible for a decrease in intraabdominal pressure, provoking respiratory and regional disorders, which are likely to influence the general status of the patient [44]. The respiratory consequences of large incisional hernias require the attention of both the surgeon and the anesthetist.

One may consider that 2 types of large incisional hernia exist: The first is large incisional hernias, the visceral contents of which are mobile through a large defect. Rives described in these a paradoxic abdominal respiration caused by an abdominal flap similar to a thoracic one. The function of the diaphragm is seriously disturbed because, during contraction, it no longer has the visceral mass to lean against. The diaphragm now only pushes viscera out of the abdominal cavity. There is no longer any synergy between the movements of the chest and the abdominal wall. Respiratory problems, often not previously detected, are prone to become more severe during the postoperative course. The results of tests of respiratory function may not be much changed, but blood gas determinations may be abnormal. The reduction of the viscera exposes the patient to little postoperative respiratory risk.

In the second type of large incisional hernia, the contents of the sac are fixed in place by adhesions and cannot reintegrate into the abdomen. Hernioured organs have lost their right of domain in the abdomen, the capacity of which has decreased. In these hernias, respiratory problems may also be hidden, especially in obese patients, because a new balance has been established. The danger appears at the moment of reduction of the herniated viscera, when the increase in intraabdominal pressure impedes normal diaphragmatic action. This change in intraabdominal pressure was studied intraoperatively by Pelli and associates [46], who found an increase in respiratory work expressed as a measurement of the thoracopulmonary compliance.

Other consequences of large incisional hernias affect divers organs. The splancnic venous system and inferior vena cava are subject to stasis caused by low intraabdominal pressure. Hollow viscera are atonic and hypokinetic for the same reason. Large incisional hernias may cause lumbar lordosis because of the inefficiency of the rectus abdominis muscular sheath. All these disorders have practical consequences, which must be evaluated by the anesthetist and the surgeon in preparing the patient for the trauma of an operation. Preoperative preparation and postoperative observation are as important as the operation itself. Indeed, the treatment of large incisional hernias is a solve 2 distinct problems: a mechanical problem—closure of the defect and loss of parietal substance, and a pathophysiological problem—recovery of normal respiratory function by surgical reininsertion of the lateral muscular belts of the abdomen.

**Treatment.** Skin preparation includes decontamination as treatment of trophic ulcers and sinuses related to nonabsorbable sutures. The operation should be delayed until 6 months after complete skin healing. General and respiratory preparation may be long and complex. Weight loss, cardiac disorders, diabetes, and renal failure are the most important complicating problems. We frequently use progressive preoperative pneumoperitoneum [7], which has an interesting triple action: (a) it enlarges the abdominal cavity, which decreases the likelihood of respiratory distress in the reduction of the contents of voluminous hernias; (b) it facilitates the intraoperative dissection of intrasacular and intraabdominal adhesions; and (c) it allows diaphragmatic functional rehabilitation by producing a high intraabdominal pressure.

Respiratory preparation is mandatory because of common preexisting problems. Preparation consists of respiratory physiotherapy, cough training, ceasing use of tobacco, and eventually postural drainage. A pressure relaxation breathing device may be used at home, obviating the need for a long hospitalization. Antibiotics may be used if necessary.

A simple repair cannot be used to treat large incisional hernias. One cannot allow additional parietal damage by a deep relaxing incision. Prosthetic repairs are a major improvement because they can be used to repair large incisional hernias, formerly considered inoperable. As in the treatment of large groin hernias, we used large pieces of polyester mesh. Experimentation [47, 48] has proved the excellent biologic tolerance of this material.

Following are the features of my associates’ and my technique [49–51], which is similar to that of Rives and coworkers [44, 45]. The piece of mesh should be as large as possible because the aim is face-to-face adhesion of the prosthesis to the parietal layer, not edge-to-edge patching. The polyester mesh is buried deeply into a retroperitoneal and extra-peritoneal space. Thus, it may be placed either in the preperitoneal space [52], for repairing a loss of substance below the level of the linea arcuata (line of Douglas) (Fig. 3), or beneath the rectus abdominis muscle (Fig. 4), in front of the posterior lamina of the
Groin and Incisional Hernias

- 4r:

A. Schematic horizontal section showing the position of the retroparietal preperitoneal prosthesis (dotted line) for a subumbilical median eventration (under the linea arcuata).

B. Schematic paramedian sagittal section showing the retroparietal preperitoneal prosthesis (dotted line) for a subumbilical median eventration.

Sheath [45]. The prosthesis, which should extend well beyond the area of the parietal defect, must be maintained by peripheral sutures transfixing the wall and tightened through cutaneous buttonholes, which are sutured closed.

All attempts should be made to bury the polyester mesh beneath a reconstructed parietal layer, even if that means making incisions in the anterior lamina of the rectus sheath.

Trivelin and associates [46] introduced an interesting means of testing the efficiency of these more or less long and deep incisions by measuring intraoperatively suture tension, abdominal pressure, and thoracopulmonary compliance.

Routine suction drainage is placed in contact with the prosthesis. The surgical environment must be the same as for all prosthetic procedures. Septic patients should not undergo operations, and aseptic conditions must be strictly enforced in the operating room. These prosthetic repairs are complex and risky operations; they are contraindicated for fragile patients.

Results. In a personal series of 466 incisional hernias, 28.5% were large incisional hernias, 85% were median hernias, 11.5% were lateral, and 3.5% were peripheral. Progressive preoperative pneumoperitoneum was used for all large incisional hernias. Seventy-nine percent of the 466 patients had prosthetic repairs; the other 21% had nonprosthetic procedures. All large incisional hernias were repaired by prosthetic procedures. Eighty-six percent of the patients who received prostheses had uncomplicated postoperative courses; 80.2% of those who had nonprosthetic repairs had uncomplicated postoperative courses. The mortality related to general risks was 1.8% for prosthetic and 5.3% for nonprosthetic repairs.

As for regional complications, the hematoma rate was 3.2% for prosthetic and 1.6% for nonprosthetic repairs. The sepsis rate was 12% for prosthetic and 10.4% for nonprosthetic repairs. None of the prostheses was since removed, and all abdomens healed after treatment of the septic accident. Findings from a mean follow-up of 5½ years were available for 65% of the patients who were operated on for large incisional hernias. The rate of satisfactory results was 85.3%. Among the entire series of patients operated on, 73.6% were reviewed after the fifth postoperative year. Prosthetic repair had an 85.5% rate of good results and nonprosthetic repair only 48%. These results, confirmed by Rives [45], may encourage experienced surgeons to use retromuscular prostheses to repair not only large but all incisional hernias.

Parastomal Hernias

Parastomal hernias are known as the least surgical of the late complications of colostomies because their cure is difficult in that the septic ambiance renders prosthetic repair almost impossible [53, 54]. The frequency of parastomal hernias seems to be higher as the survival period grows longer and the series
Despite this being a rather serious operation and is to be reserved for patients at low risk, I had satisfactory results in the 3 operations I performed. I replaced skin suturing with polydioxanone banding in 4 operations and had good results every time, but there was 1 prolonged suppuration.

**Strangulating Incisional Hernias**

As in all hernias, strangulation is a dangerous complication. Seeming to be a long-lasting episode of incarceration, it is often seen late, when meteorism, transit arrest, dehydration, fever, and, of course, an irreducible tender hernia exist. In Hjaltason's series [8], strangulating incisional hernias occurred in 3.5% of patients operated on. 3.1% in a personal series of 466 patients. Hjaltason reported a 1:1 sex ratio, whereas Dennis and Enquist [19] observed a 1:4 male-to-female ratio. The contents of strangulating incisional hernias are mostly intestine and omentum. Conversely, the colon is rarely involved. When it is, the strangulating agent is often an intrasacular cord or a sacular diverticulum.

Among nonsurgical methods, we have tested the efficiency of emergency pneumoperitoneum as proposed by Mousseau and associates [66] when an urgent operation is too risky because of the poor general condition of the patient (advanced age, obesity, cirrhosis). But one must be prudent because reduction of a necrotic or twisted loop must be feared.
The surgical techniques carried out for strangulating inci-
dental hernias are not different from those applied to other
hernias. Difficulties related to the contents, adhesions, and
possible lesions of herniated organs are similar to those encoun-
tered in all large strangulating hernias. Prostheses are not
recommended in emergencies because correct local prepara-
tion is impossible. The repair of the wall, thus, should be as simple
as possible—for example, the Mayo-Judd technique. When the
wall is extremely damaged, but the general condition is good, a
piece of polyglactin mesh placed intraperitoneally seems to be a
good means of holding the suture under tension while the wall
seals.

Conclusion

The complicated aspects of groin and incisional hernias form a
necessarily compound list of diverse problems in surgical
parietology: difficult or emergency problems that are dangerous
for patients and problems complicated by recurrence. The latter
were added here intentionally because they are much more
complicated to treat than primary hernias. As for the treatment
of complicated hernias today, not much has changed during the
past 40 years. Strangulating hernias necessitate preventive or
curative treatment of ischemic necrosis of the contents. In
gigantic hernias, a lasting solution of the mechanical problem is
difficult without large prostheses. Recurrent hernias must not
be repaired by the same techniques used to treat the initial
hernias. Last, the best prevention of complicated hernias is
probably to consider the systematic surgical repair of all diag-
nosed hernias and to select a procedure adequate to prevent
recurrence. Surgical repair using a prosthesis is an almost
absolute weapon in sepsis-free patients whose hernias are prone
to recur.

Résumé

Edoardo Bassini disait, il y a 100 ans: "L'ernia è una malattia
meccanica." Avant lui, Ambroise Paré (1598) et Joseph-Pierre
Desault (1798) avaient déjà affirmé le caractère mécanique de
l'étranglement. De cette complication événementielle, la plus
grave de toutes encore de nos jours, les auteurs ont étudié une
complication par nature, les hernies géantes, et une situation
qui complique le traitement, les hernies récidivées. Dans les
cadres distincts des hernies de l'aíne et des hernies incision-
nenles, ont été brièvement étudiées les incidences et les consé-
cuences diagnostiques et tactiques des accidents. Quant à
leurs traitements, une opposition nette apparaît entre les étran-
glements et les hernies géantes et récidivées. Les premiers
accidents, circonstances-types de la chirurgie urgente, n'ont
guère bénéficié de progrès techniques importants. Alors que les
autres peuvent de nos jours être mieux préparés à l'intervention
grace à une meilleure connaissance de la physiopathologie, ils
représentent pour les auteurs des indications fréquentes des
réparations prosthétiques modernes. Les prostheses utilisées par
les auteurs sont de très larges pièces de tulle de Dacron
profondément insérées dans le feuilletage pariétal en dehors du
peritoine et sous la paroi musculaire, comme une sorte de fascia
endo-abdominal artificiel, qui rend instantanément et définitiv-
ément étanche la paroi abdominale. Dans l'état actuel du
développement de la chirurgie herniaire, les complications
sérieuses étudiées dans ce travail doivent inciter à envisager la
cure chirurgicale systématique de toutes les hernies.

Resumen

Hace más de cien años Edordo Bassini dijo: "la hernia es una
enfermedad mecánica." Anteriormente Ambroise Paré (1598) y
Joseph-Pierre Desault (1798) afirmaron la naturaleza mecánica
de la estrangulación. Además de la estrangulación, que es la
más seria de todas las complicaciones aún en la actualidad, he
estudiado hernias enormes, que constituyen una forma de
complicación natural, y hernias recurrentes, que son complica-
ciones de reparaciones subóptimas. En el presente artículo se
considern los caracteristicas generales y las consecuencias de
caracter diagnóstico y técnico de la reparación de hernias
inguinales e incisionales. El tratamiento de las hernias en
proceso de estrangulación, usualmente en condiciones de emer-
gencia, aún da tiempo para una preparación preoperatoria
adecuada del paciente. Estas hernias también son susceptibles
de reparación con técnicas protésicas modernas. En las repara-
ciones protésicas se colocan grandes piezas de malla de poli-
estér bajo la pared muscular, por fuera del peritoneo; actúan
como una fascia no absorbible endoabdominal, dando a la pared
abdominal firmeza instantánea y definitiva. El estado de la
cirugía herniaria ha avanzado hasta el punto de que uno debe
contemplar la curación sistématica de toda hernia que sea
diagnosticada.

References

Hernia, 3rd edition, L.M. Nyhus, R.E. Condon, editors, Philadel-
phia, J.B. Lippincott. 1989, pp. 253-265
301-329
digestive en France: Une enquête épidémiologique nationale (1978-
9:900005-10, 1974
5. Houdard, C., Stoppa, R.: Le Traitement des Hernies de L'aíne,
Monographie de l’Association Francaise de Chirurgie, Paris, Mas-
on Ed., 1984
de Dacron dans leur traitement. Thèse Méd., Amiens, 1982
7. Gothi Moreno, I.: The rational treatment of hernias and voluminous
chronic eventrations: Preparation with progressive pneumoperito-
neum. In Hernia, 2nd edition, L.M. Nyhus, R.E. Condon, editors,
10. Stoppa, R., Petit, J., Abourachid, H.: Procédé original de plastie
des hernies de l’aíne: L’interposition sans fixation d’une prothèse
tenue de Dacron par voie médiane souspéritéonale. Chirurgie
99:119, 1973
11. Stoppa, R., Petit, J., Henry, X.: Unsuturated Dacron prosthesis in
groin hernias. Int. Surg. 60:411, 1975
reticulées non résorbables dans le traitement des hernies de l’aíne.
Chirurgie 107:333, 1981