

Strangulated Femoral Hernia: *

A Review of 170 Cases

FRANK A. ROGERS, M.D.

From the College of Medical Evangelists, Los Angeles County General Hospital, California

A STUDY of a relatively large group of cases of strangulated femoral hernia was undertaken in order to point out factors which most influenced the mortality and to evaluate methods of surgical treatment. Recently femoral hernias have attracted less attention in the literature than in earlier years. The relative high mortality associated with the acutely incarcerated femoral hernia suggests that a reappraisal of the recognition and treatment of this type of hernia will be of value. An analysis of 170 cases treated over a 15-year period on the College of Medical Evangelists surgical service at the Los Angeles County Hospital is presented.

Anatomic Features: A femoral hernia is more likely to undergo acute incarceration and subsequent strangulation than any other common hernia. Strangulation may occur at any time and constitutes an urgent surgical emergency. It is estimated that strangulation occurs in approximately 10 per cent of all femoral hernias.^{5, 31} Acute incarceration occurs more frequently in this type of hernia because the small femoral ring through which the herniation occurs is more rigid and because herniation through the defect occurs in a more vertical or downward direction. It is this latter factor, uniquely characteristic of the femoral canal hernia, which contributes to the difficulty in reducing it. Once entrapped, the contents of the sac are inhibited in returning to the abdomen by the well defined and narrowed margins of the hernia defect. When inter-

ference with circulation occurs the strangulation affects the contents of the sac and the tissues which make up the sac—the parietal peritoneum, properitoneal tissue and transversalis fascia.

The femoral ring is bounded laterally by the femoral vein, anteriorly by the inguinal ligament, medially by the lacunar or Gimbernat's ligament and posteriorly by the superior ramus of the pubic bone covered by Cooper's ligament. It is through this narrowly confined space that all femoral herniae must emerge, except the very rare lateral femoral hernia which occurs lateral to the neural bundle.

Sex Incidence: During the period 1941 to 1955 there were 1,427 femoral hernias admitted to the two medical school services of Los Angeles County General Hospital (University of Southern California and College of Medical Evangelists). Of this number, 323 cases or 23.6 per cent were treated with acutely incarcerated, irreducible femoral herniae. These were approximately equally divided between the two medical school services.

The sex incidence of all studies on all femoral hernia favors the female. When a group of 1,716 cases from the literature^{8, 9, 11, 20, 26, 31, 32} are averaged, the sex incidence is exactly two to one. In the 1,427 County cases including acute and chronic hernias, the ratio was slightly less than 2 : 1. In the present study of 170 acutely incarcerated hernias 68 per cent were females and 32 per cent males. There were twice as many males treated in the first half of this period of the study as in the latter half. Out of the total hospital admissions for acute femoral herniation there were 14

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Negro females and two Negro males. Thus Negroes made up 5 per cent of the total patients in this study. Shelby recorded a 2.3 per cent incidence of Negro patients.³⁴ Since the average hospital Negro census during these years averaged 22 per cent, it appears that femoral hernias may occur with relative less frequency in the Negro race.

Predominance of Side of Herniation:

As in the case of inguinal hernias, femoral hernias occur on the right side twice as frequently as on the left.^{8, 9, 10, 16, 17, 27, 31, 34} This is difficult to explain but is probably partially accounted for by the predominance of right handedness and increased strain on the right side of the body. Occurrence of bilateral femoral herniation is not uncommon and ranges from 4 to 9 per cent.^{25, 35} The occurrence of bilateral strangulated femoral hernias is a rarely recorded event.^{18, 31}

Age: The distribution by age is shown in Table 17. Previous studies have shown that a maximum number of patients with femoral hernias are in their fourth, fifth and sixth decades.^{5, 8, 11, 14, 20, 26, 31, 32, 36} In the 90 cases studied by McClure and Fallis, over 75 per cent were between 30 and 60 years of age. In 139 cases reported by Koontz, 84 per cent were between 30 and 70. As is usual for any group of cases reported from the Los Angeles General Hospital the average age of the patients is a great deal higher than most similar reported series. Only 25 per cent of this group were between 30 and 60 years of age, while 71 per cent were in the seventh, eighth and ninth decades. Because age is always a factor affecting results of surgical treatment, the advanced age of this group is significant. There are several

TABLE 1. *Duration of Hernia Prior to Incarceration*

0-1 year	28
1-3 years	13
3-5 years	10
5-10 years	17
Over 10 years	30

TABLE 2

	Signs
Tenderness over hernia	75
Abdominal distention	55
Visible peristalsis	6
Blood in stool	2
Melena	2

reports of strangulated hernias in infants.^{2, 9, 13, 22, 33, 37} Strangulation of a femoral hernia, however, may occur at any age. The youngest recorded case was that of a five week infant male reported by Underhill. Pfeiffer and Sain record the case of a month old female with an incarcerated right tube and ovary. A five-month-old female with strangulated ectopic endometrial tissue was included in the series by Jarboe and Pratt. Two patients in this series were in the tenth decade and both were treated successfully.

Past History; Signs and Symptoms:

In the majority of instances the patients were aware of their hernia. A history of known herniation was given by 105 patients in this series. Of this group eight had had previous incarcerations. The diagnosis was made for the first time in 61 patients or 40 per cent of the group. There were 12 deaths among those who knew of their hernias. Most of these deaths could have been prevented by elective repair of the hernia. In the series reported by Jarboe and Pratt 65 per cent of the patients were aware of the existence of their hernia prior to the time of the acute episode. Pfeiffer and Sain reported an incidence of 82 per cent in their group of acute and chronic hernias. Strangulation occurred without knowledge of previous hernia in 16 per cent of Peden's cases. Strong emphasis should be placed here since the elective repair of femoral hernias carries an exceedingly small risk, whereas the mortality from surgical treatment of strangulated femoral hernia remains high. Table 1 indicates that a large number of acute incarcerations occurred within one year after the hernia first made

its appearance. Twenty-eight, or about 30 per cent, fall under this category, while another 30 per cent had the hernia over ten years before trouble ensued. In another large series³¹ the average known duration of the hernia was 12 years. The duration of the hernia appears to be unrelated to the sac contents or to the subsequent results of treatment.

Clinical Signs and Symptoms: Although the purpose of this paper is not to present clinical behavior of these cases, Tables 2 and 3 indicate the relative frequency of certain signs and subjective symptoms associated with the acutely incarcerated or strangulated femoral herniae. Jarboe and Pratt (1949) have presented a detailed study of clinical manifestations associated with the acutely incarcerated femoral hernia, and there are other excellent reviews.^{1, 5, 7, 9, 17, 27, 31} In general the acutely strangulated hernia containing small bowel produces more pronounced symptoms indicative of mechanical intestinal obstruction. When structures other than small intestine are incarcerated and subsequently strangulated, the symptoms and signs are often less dramatic. The usual history is that of a sudden onset of pain frequently noted in the region of a previously reducible hernia which has become firm and irreducible. The abdominal pain is poorly localized at first and later becomes cramping in nature. The onset of incarceration is associated with increased exertion in approximately one-third of the cases.^{5, 26, 28} However, many cases occur with no unusual effort.

The majority of patients reached the hospital soon after the onset of symptoms. The

TABLE 4. *Duration of Acute Symptoms*

	Cases	Mortality
0-24 hours	62	
24-48 hours	16	5%
2-3 days	31	
3-4 days	17	13%
Over 5 days	39	23%

duration of acute symptoms prior to reaching medical care is summarized in Table 4. The mortality increased as the period of delay lengthened. In this summary patients with only omentum strangulated are included, a fact which keeps these mortality statistics from being higher.

Vomiting occurs early and is a prominent symptom. A mass in the femoral region is the most important single physical finding. Many times the mass is completely overlooked and in other instances its significance is often misinterpreted. Acute strangulation of a femoral hernia is a common cause of acute intestinal obstruction among patients more than 50 years of age. If the diagnosis is thought of and properly examined for, the condition is usually not difficult to diagnose.

The classical symptoms of intestinal obstruction are usually present in cases of strangulated femoral hernia. When intestinal colic associated with vomiting suggests a diagnosis of probable acute intestinal obstruction hernial orifices should be carefully examined for the presence of a mass. With care, a differential diagnosis between a femoral hernia and an incarcerated inguinal hernia can be made. The femoral hernia is palpable below and lateral to the pubic spine, while the inguinal hernia is found to lie superiorly and medially to the pubic spine. Frequently the femoral hernia mass protrudes forward and upward to partly obscure the inguinal ligament.

Effect of Delayed Diagnosis: The correct diagnosis was made in 80 per cent of cases preoperatively in this group (Table 5). This percentage of correct diagnosis is

TABLE 3

	Symptoms
Nausea-vomiting	126
Nausea only	13
Cramping pain	79
Constant pain	32
Constipation	53
Diarrhea	7

higher than that found in other series.^{5, 7, 15, 31} The diagnosis was made in another 31 cases, or 19 per cent of the total series, at surgery. Two cases died undiagnosed, representing 1 per cent of the group. The mortality was 11.4 per cent among those diagnosed preoperatively and 13 per cent in the group where the diagnosis was made at surgery. Where the proper diagnosis of these patients was made either in the general admitting room or by the initial admitting ward, the over-all mortality was extremely low (10%). As indicated in Table 5, this information was obtainable in 138 instances. When the patients had been admitted to hospital services other than general surgery and the proper diagnosis was delayed until made by surgical consultation, the mortality reached 50 per cent. The incidence of gangrene rises sharply as the delay in diagnosis increases. Delay in reaching surgery for any reason greatly increases the number of deaths.

A sharp increase in the mortality was noted when the proper diagnosis was delayed for more than 24 hours. The correct diagnosis was made in 145 cases in less than 24 hours (Table 6). Of these, 128 were diagnosed in the emergency room or on their arrival to the primary admitting ward. Seventeen others were either initially directed to medical wards or were already in the hospital on services other than general surgery when their acute incarcerations occurred, but were also diagnosed correctly in 24 hours or less. Only 12 deaths occurred among the patients diagnosed in less than

TABLE 5. *The Effect of Delayed Diagnosis*

	Cases	Per Cent Mortality
Preoperatively	132 (80%)	11.4
At operation	31 (19%)	13.0
At autopsy	2 (1%)	100.0
Hospital Admitting		
Room or Ward	128	10.0
Consultant	10	50.0

TABLE 6. *Diagnosis by Time Intervals*

	Cases	Deaths	Mortality
0-24 hours	145	12	8.3%
24-36 hours	5	2	47.0%
36-48 hours	2	2	
48-72 hours	3	2	
Over 72 hours	7	2	

24 hours (8.3%). Among 17 other patients where diagnosis was delayed over 24 hours there were eight deaths (47%). Early diagnosis of this type of hernia appears to be the most important single factor in affecting good results. The correct diagnosis was made in a higher percentage of cases when the patients knew of their hernia prior to the acute incident. It was delayed when there was lack of tenderness in the hernia or the hernia was not visible or palpable.

Effect of Electrolyte Imbalance: Although the treatment for incarcerated or strangulated femoral herniae is early surgery, many of the patients reached the hospital in various stages of shock. Others had suffered a good deal of fluid and electrolyte loss and required some delay in treatment while partial replacement therapy could be carried out. Table 7 summarizes the number of patients who had significant preoperative electrolyte disturbances to give abnormal NPN, serum chloride and carbon dioxide readings. Such abnormalities were noted in 53.5 per cent of all patients. Among males the mortality was 35 per cent, while females exhibiting comparable abnormal electrolyte imbalance had only a 22 per cent mortality.

Operative Approach and Repair: The basic repairs for femoral hernia have traditionally been done either from above or below the inguinal ligament. More than 60 operative technics have been described and a good deal of discussion has taken place in the literature regarding the preferred surgical approach for the acutely incarcerated femoral hernia. In general, proponents of an inguinal approach outnumber those

who favor the femoral approach. The earliest operative attempts, however, dealt directly with the hernia sac from below the ligament. Bassini (1894) originated the operation from below using the pectineus fascia, falciform process and Poupart's ligament to close the femoral opening with either a pursestring or mattress suture. A similar operative technic was described by Cushing in 1888.

The inguinal approach was used by Anandale (1876). This was a simple procedure which plugged the femoral canal by suturing the sac into it. Ruggi (1892) first sutured the inguinal ligament to Cooper's ligament. Moschowitz popularized this technic in the United States and added an inguinal hernioplasty to the procedure to prevent an inguinal herniation. Suturing of the conjoined tendon to Cooper's ligament was described by Lotheissen (1898). This method has also received approval by McVay and Anson. These latter two authors criticized the Ruggi-Moschowitz procedure in that the suturing of Poupart's ligament to Cooper's transposed tissue planes and opposed one yielding structure to an unyielding structure.

The abdominal approach was first used by Tait (1883) while operating for an ovarian tumor. According to Koontz, H. A. Kelly used this method at Johns Hopkins and was followed by other gynecologists. In the early days Kelly plugged the opening in the femoral canal with a glass marble and closed peritoneum over it.

The suprapubic extra-peritoneal approach (Cheatle-Henry)^{4, 12} is particularly deserving of attention and has found favor among the residents at the Los Angeles County General Hospital, where it was first used

TABLE 8. *Surgical Approach*
(168 cases)

	Cases	Deaths
Femoral	10	0
Inguinal	112	14
Retro pubic (1949)	29	4
Right rectus	10	0
Other	7	2

and popularized by Mikkelsen. As indicated in Table 8 the retropubic approach has only been used since 1949. In 1954 Mikkelsen and Berne reported briefly on 214 patients with femoral hernias treated over a four year period at the Los Angeles County Hospital. The Cheatle-Henry extra-peritoneal or retropubic approach was used on 113 of these. Experience with this technic has shown it to be superior to other methods of approach to femoral hernia because of the unusually good exposure of the femoral canal from above. It allows an excellent repair of the femoral defect and is far more advantageous in dealing with gangrenous bowel than any of the inguinal or femoral approaches. This approach also allows exposure of the opposite femoral ring where a femoral defect exists in approximately 20 per cent of patients²⁵ (Fig. 1 a, b, c).

An adequate approach is of primary importance in dealing with strangulated intestine. In addition the approach should give the added advantage of an easy, secure repair since recurrence rates are high following repairs for strangulated femoral hernia, especially where there is gangrenous bowel.^{5, 28, 36, 38}

Results of Treatment: This study on acutely incarcerated and strangulated femoral hernia was undertaken primarily to discover the results of treatment for this condition and the factors significantly affecting these results. The data from available clinical charts was tabulated by I.B.M. machine. Because of the mass of detailed data available with the use of I.B.M. tabulation only brief comments will be made

TABLE 7. *Electrolyte Imbalance and Mortality*

Males	28	35%
Females	63	22%
91 of 170 with electrolyte abnormalities	—	53.5%

regarding the data to be presented on mortality. The tables referred to summarize the data succinctly.

The results of treatment are affected by many variables. The effect of long duration of symptoms and the importance of diagnostic accuracy have already been pointed out. In Table 9 the results of operative treatment for right and left strangulated femoral hernia are summarized. The marked difference in mortality is difficult to explain. An analysis of data which might produce differences in fatality results on opposite sides was carried out. Conditions such as the contents of the sac, associated diseases, duration of operative procedure, the incidence of non-viable bowel and age and sex were used. No one factor or set of conditions seem to fully explain the difference in mortality between the right and left hernias.

Duration of Operation: Table 10 indicates the number of procedures which were done in arbitrary divisions of operative time. No effort is made here to tabulate separately the operative times for cases re-

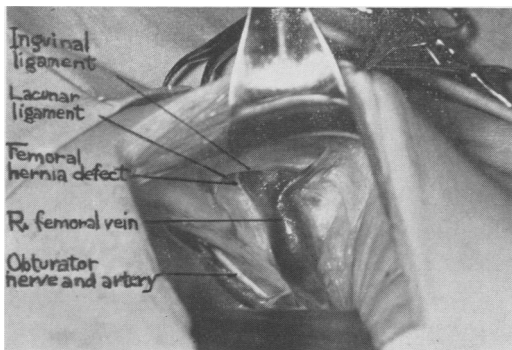


FIG. 1. (A) Through a supra pubic transverse or vertical incision the fascia over the recti muscles is divided, the right rectus muscle is retracted laterally and the underlying peritoneal sac is easily pushed away from the inner surface of the inguinal ligament and superior ramus of the pubis (Cheatle-Henry approach to the retro pubic space). In this photograph the femoral hernia defect is seen medial to the femoral vein bounded by the inguinal ligament above, the lacunar (Gimbernat's) ligament medially and the superior right pubic ramus inferiorly covered by Cooper's ligament. This approach affords an excellent view of the femoral canal area as well as the obturator nerve and lateral femoral and iliac lymph node areas.

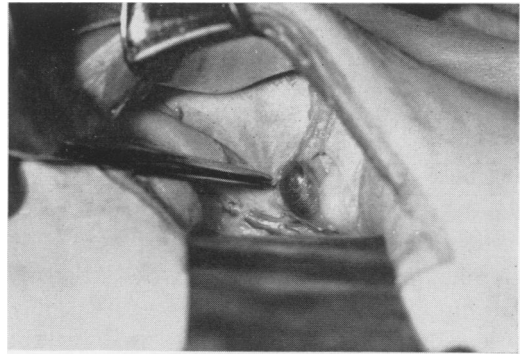


FIG. 1. (B) The transversalis fascia is pulled downward to approximate with Cooper's ligament and effectively close the femoral defect.

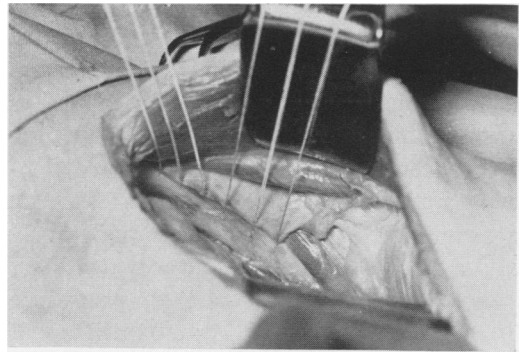


FIG. 1. (C) The repair has been completed by uniting the transversalis fascia to Cooper's ligament with interrupted sutures of cotton.

quiring bowel resection and those where other simpler procedures were carried out. This analysis, however, shows that the mortality rate remained approximately 8 per cent for all operative procedures performed in 100 minutes or less. The 43 procedures which required more than 100 minutes produced eight deaths or a mortality of 20 per cent. When the length of the operative procedure was related to the various surgical approaches it was noted that less operating time, regardless of procedure, was required for the retro pubic or Cheatle-Henry approach. The effect of longer operating time was more notable when related to the presence or absence of other associated diseases (Table 16).

Sac Contents: The contents of the hernia sac influence greatly the results of surgical

treatment. In Table 11 are summarized the viscera usually encountered in the femoral hernia. Several studies^{1, 6, 8, 10, 16, 31} have pointed out the high mortality associated with incarcerated small bowel as compared with other incarcerated or strangulated viscera. In Table 11 omentum was also present in many of the cases tabulated under small bowel or ileum. In this study the presence of omentum with loops of small intestine in the sac did not significantly lessen the seriousness of the hernia. When omentum alone was strangulated, the mortality was low. There were a large number of Richter's hernias in this series. Koontz recorded an incidence of 3.6 per cent in his series of elective and emergency hernias, while Jarboe and Pratt noted a 14.4 per cent incidence. No case of a Littre's hernia³⁰ occurred in this series. There was no case of gangrene involving colon, ovary and tube or cecum or appendix.

The clinical signs and symptoms are less dramatic and severe when the strangulation does not involve bowel. The chief factors influencing symptomatology and prognosis are presence or absence of small bowel in the hernia sac and the presence or absence of gangrene. The combination of gangrene in a loop of small bowel is a lethal combination. Table 12 tabulates the mortality per cent associated with gangrenous bowel in various series since 1900. The average mortality for these 16 series is 54 per cent. Table 13 lists the operative mortality of several series dealing with strangulated femoral hernia. The average mortality for these 11 series reports was 21 per cent. These tables indicate very little improvement in mortality statistics over the years.

The most difficult problem associated

TABLE 9. Operation Performed

Right femoral hernia		115
deaths 17	mortality 15.5%	
Left femoral hernia		49
deaths 3	mortality 6.0%	

TABLE 10. Operative Time

	Cases	Deaths	
20-40	17	0	
40-60	37	5	8%
60-80	44	2	
80-100	25	4	
100 and over	43	8	20%

with the surgical treatment of the strangulated femoral hernia involves the proper recognition and treatment for gangrenous bowel. A careful study of some series indicates that occasionally fatalities resulted where nonviable bowel was returned to the abdominal cavity following release and repair of the hernia. There were no such instances in this series. There were 35 small bowel resections with nine deaths, a mortality of 26 per cent. Most of the anastomoses were done with end-to-end open two layer suture technics. There were no deaths from leaking anastomoses.

Although several tests have been described to determine bowel viability^{3, 40} the need for resection should be obvious to the experienced surgeon. The fluorescein and procaine tests are time consuming and still require experienced interpretation. If doubt exists, resection is the safer course.

Table 14 summarizes the operations performed for this series of cases and indicates that the majority were treated by release of the incarcerated or strangulated viscera and repair of the hernia. In four patients whose conditions were critical no attempt at repair was made and the sac contents were simply released, with one fatality. A bilateral repair was done in three instances using the retropubic extraperitoneal approach. The mortality associated with release and repair of 160 hernias was 12 per cent.

The twofold increase in mortality associated with resection of gangrenous bowel emphasizes the seriousness of this condition. In several instances it was necessary to section the lacunar ligament to release the constricted sac. Dennis and Varco have out-

lined a method of dividing the inguinal ligament in cases requiring bowel resection. Their subsequent repair of the hernia was done after the method of McVay and Harkins. Division of the inguinal ligament was not done in the present series.

The presence of gangrenous bowel within the femoral hernia sac is usually made obvious by the dark, odorous, hemorrhagic fluid. In this situation Dennis and Varco have recommended deferring release of the hernia until the blood supply to the gangrenous loop has been divided. The experimental work of Knight and others has indicated the presence of a highly toxic substance with depressor effect in exudate from nonviable segments of intestine.

The resection of gangrenous bowel must be adequate. A careful examination of the strangulated portion of bowel, as well as proximal and distal bowel, must be made in questionable cases. Although rare, gangrene has occurred in a segment of bowel within the abdomen. This has been referred to as "retrograde strangulation." It was described by Laroyenne in 1910 and has been referred to as a "W" or Maydl's hernia.²⁴ In this type of hernia segments of bowel proximal and distal to an infolded portion of bowel may be come incarcerated within the hernia sac without loss of viability. However the infolded loop by strangulation may become infarcted. Another explanation for intra-abdominal gangrenous bowel is the extension of a thrombotic process from clotted vessels within the herniated intestine mesentery.

In many Richter's hernias only a portion of the circumference of the occluded loop is non-viable. This represents a specific

TABLE 12. *Summary of Mortality Associated with Gangrenous Bowel*

Author	Year	Cases		Per Cent Mortality
		Gangrenous Bowel	Deaths	
Gibson	1900	354	120	34
Becker	1922	24	6	25
Springer	1924	16	9	56
Frankau	1931	116	40	34
McIver	1933	8	4	50
Bowers	1935	5	4	80
Dunphy	1940	20	10	50
McNealy	1942	33	20	60
Dean	1942	—	—	83
Adelaide	1943	12	8	66
Hay	1943	6	6	100
Jens	1943	19	10	53
Jarboe	1949	26	19	73
Pfeiffer	1951	12	3	25
Peden	1951	40	18	46
Rogers	1958	35	9	26

problem. In the past many such areas have simply been inverted with a series of interrupted sutures placed in the transverse axis of the bowel (Summer's stitch). Six cases in this series received such treatment with one death. Other records show as high as 40 per cent mortality with this technic. With any extensive necrosis, a resection is indicated. Four of five cases in the Mayo clinic group^{15, 16} treated with inversion died directly due to the use of this technic. Three of these were obstructed at the site of inversion and the fourth died from perforation and leakage.

Proximal decompressing enterostomy was not done in this series of cases, and no case was treated by double barrelled enterostomy. In other series where exteriorizing procedures have been carried out the mortality has been extremely high. Peden reported seven cases treated by exteriorization, all of whom died. McNealy reported nine deaths in eleven such cases.

The Influence of Associated Diseases on Mortality: Of particular influence on this group of patients reported from the Los Angeles General Hospital was the presence of associated diseases. Table 15 lists seven disease categories and the numbers

TABLE 11. *Sac Contents and Mortality*

	Cases	Per Cent Mortality
Small bowel; ileum	130	17
Colon	2	
Ovary and tube	2	
Cecum or appendix	1	
Omentum	41	5

of patients afflicted in each group. Included in these categories are such associated diseases as congestive heart failure, myocardial infarction, pulmonary tuberculosis, chronic glomerulonephritis, cerebral vascular accidents, severe degrees of malnutrition and infections in systems other than the gastro-intestinal tract. There were 26 males and 54 females who had one or more associated diseases severe enough to definitely increase their operative risk. Although the same relative numbers of males and females had associated diseases, once again the marked disparity in mortality was seen with a 35 per cent mortality for males and 18.5 per cent for females.

The influence of prolonged operative time on patients with and without associated disease is summarized in Table 16. Although Table 11 indicated no sharp increase in mortality for the combined group until after 100 minutes of operative time, the effect of associated disease is clearly seen when the factors of prolonged surgery and combined diseases are analyzed together. Patients with no associated disease withstood the longer operating times with no significant increase in deaths, while in those with associated diseases the deaths increased many-fold.

Anesthesia: The effect of the method of anesthesia on the results of surgical treatment was not specifically studied in this

TABLE 13. *Operative Mortality of Strangulated Femoral Hernia*

Author	Year	Cases	Per Cent Mortality
Gibson	1900	101	23.8
Beller; Colp	1926	76	20.0
Frankau	1931	680	12.9
McIver	1932	34	17.7
Fergusson	1937		23.1
Shelley	1940	37	25.9
Dean	1942	31	32.0
Jens	1943	100	14.0
Jarboe; Pratt	1949	104	23.1
Peden	1951	107	23.8
Rogers	1958	170	13.0

TABLE 14. *Operation Performed*

	Cases	Deaths	Per Cent Mortality
Release sac contents	4	1	
Release and repair	160	19	12
Small bowel resection	35	9	26
Invert bowel wall	6	1	
Bilateral repair	3	0	

series. Some authors ^{1, 6, 7, 17, 38, 40} have been emphatic in preference for local anesthesia. In Peden's series the mortality was lowest when spinal anesthesia was used and highest with local anesthesia. From a study of this group of patients it is felt that local anesthesia is inadequate to deal properly with complications such as gangrenous sac contents. The large number of patients who have intestinal obstruction increases the hazard of vomiting during surgery. The general trend in handling this type of patient has been to empty the stomach preoperatively and send the patient to the operating room with an indwelling naso-gastric tube. The preference for endotracheal anesthesia with inflated cuff has been noted recently and is felt to be the anesthetic of choice. A high concentration of oxygen can be given and the dangers of aspirating vomitus and the problem of hypotension occasionally associated with elderly patients in borderline shock are avoided.

Influence of Age on Mortality: The adverse influence of advanced age on the results of treatment is seen by the tabulated summary in Table 17. Here the numbers of patients in each sex are listed by decade. Only one patient under the age of 50 died, an operative mortality of less than 5 per cent. Above the age of 50 the mortality generally increases with age, although the two female patients, aged 92 and 98 respectively, both survived their illness.

Variation in Mortality Between Sexes: The striking difference in mortality for males and females has frequently not been cited in previous reviews on this type of acute hernia. Peden found an operative

mortality of 26.1 per cent in females and 18.7 per cent in males. Table 18 indicates clearly that the mortality among the males was a good deal higher than that among female patients in this study, and this was also true in the review of 680 cases by Frankau. The over-all mortality was 13 per cent. Females withstood the effects of acute femoral hernia incarceration far better than males and exhibit a 10 per cent mortality with eleven deaths in 116 cases. The male mortality was double this with eleven deaths among 54 patients, a 20 per cent mortality. All of the female patients were operated. Two of the male patients died unoperated, and the correct diagnosis was made at autopsy.

It is difficult to fully explain the variation in mortality between the sexes. There were more delayed diagnoses among male patients to partially account for this difference. Delay in correct diagnosis gave rise to delay in surgical treatment and was associated with a sharp rise in mortality.

An analysis was done to ascertain the seriousness of the side of the hernia in each sex. It was found that there were 7 per cent more right-sided male hernias than female. This becomes significant when it is related to the increased incidence of small bowel incarceration in right-sided hernias. The ratio of right-sided hernias to left was 2 to 1. The ratio of hernias on the right side which contained strangulated small bowel to those on the left side was 3 to 1.

However, there were essentially the same relative number of elderly male and female patients, and the per cent of associated diseases was equal in both sexes. A survey of

TABLE 15. *Associated Diseases*

Cardiovascular	43
Pulmonary	13
Renal	8
C.N.S.	14
Malignancy	4
Malnutrition	4
Infection; sepsis	11

TABLE 16. *Effect of Operative Time on Patients With and Without Associated Diseases*

	Minutes	
	20-60	Over 60
Associated disease	25	53
deaths	4	13
No associated disease	29	59
deaths	1	2

the numbers of male and female patients whose hernia sac contained small bowel revealed essentially no difference and the same ratio of right to left hernia existed. On both medical school services at the Los Angeles General Hospital from 1941 to 1955 there were a total of 72 patients with strangulated femoral hernia who required bowel resection. There were 50 females and 22 males, the same ratio of sexes as was noted for femoral hernia in general. Of this larger group of patients requiring small bowel resection there were only 10 female deaths with an operative mortality of 20 per cent, while the male operative mortality was 60 per cent.

Postoperative Complications: There was a total of 42 postoperative complications in 37 cases. The wound infection incidence was 6.6 per cent with 11 patients manifesting some degree of suppuration in operative incisions. The majority of these were noted in patients who had had excision of gangrenous small bowel.

There appeared to be no relationship between prolonged operating intervals and an increase in the number of postoperative complications but a definite relation was seen, as would be expected, among those cases with other associated diseases. Table 19 lists the more severe postoperative complications and gives the number of deaths attributable to each of these. Shock accounted for the largest number of postoperative deaths, while atelectasis with pneumonia and shock occurred as postoperative complications most frequently and were seen in a total of 24 instances. Congestive

heart failure, renal failure, cerebral vascular accidents, pulmonary embolism, coronary occlusion, phlebothrombosis and gastro-intestinal hemorrhage were problems in other postoperative cases.

Summary

The general features of strangulated femoral hernia have been outlined and results from a study of 170 cases of acute incarcerated femoral hernia from the College of Medical Evangelists Surgery Service at the Los Angeles County Hospital have been compiled.

There were 116 females and 54 males, 71 per cent of whom were in the age decades 60 to 90.

The seriousness of delayed or incorrect diagnosis is emphasized. The influence of age, sex, presence of other associated diseases, electrolyte imbalance, duration of operative time, sac contents and the side affected on mortality is summarized.

An adequate surgical approach is important and the excellence of the Cheatle-Henry extraperitoneal, retropublic operation is described.

The overall mortality for this group was 13 per cent. The male operative mortality was 20 per cent while that female patients was only 10 per cent. The results of this group are compared to other reports.

There were 35 bowel resections for gan-

TABLE 17. *Age Decade, Sex and Mortality*

Age	Total Cases	Male Cases	Deaths	Female Cases	Deaths
0-9	2	1		1	
10-19	2	1	1	1	
20-29					
30-39	7	2		5	
40-49	11	3		8	
50-59	28	13	3	15	2
60-69	38	13	1	25	2
70-79	58	12	3	46	4
80-89	22	9	3	13	3
90-99	2			2	
	170	54	11	116	11

TABLE 18. *Mortality*

Over-all Mortality—13%	
Females	116
deaths	11
mortality	10%
Males	54
deaths	11
mortality	20%

TABLE 19. *Postoperative Complications*

	Cases	Deaths
Atelectasis; pneumonia	12	7
Shock	12	10
Heart failure	5	5
Renal failure	4	4
C.V.A.	2	1
Pulmonary embolus	1	1
Coronary occlusion	1	0
Phlebothrombosis	2	0
G.I. hemorrhage	3	1

grenous small bowel with nine deaths, a 26 per cent mortality. No deaths were due to faulty anastomoses. Postoperative complications occurred in 37 patients and there was a 6.6 per cent wound infection rate.

An elective repair of all femoral hernias is advisable.

Bibliography

1. Beller, A. J. and R. Colp: Strangulated Hernia from the Standpoint of the Viability of the Intestinal Contents: Report of 278 Cases. *Arch Surg.*, 12:901, 1926.
2. Birt, A. B.: Some Views on Femoral Hernia and the Treatment. *Practitioner*, 159:362, 1947.
3. Braun, W. and W. Wortmann, quoted by J. O. Herrlin, Jr., S. T. Glasser and R. Lange: New Methods for Determining Viability of Bowel. *Arch. Surg.*, 45:785, 1942.
4. Cheatle, G. L.: An Operation for the Radical Care of Inguinal and Femoral Hernia. *Brit. M. J.*, 2:68, 1920.
5. Dean, G. O.: Strangulated Femoral Hernia. *Arch. Surg.*, 44:933, 1942.
6. Dennis, C. and R. L. Varco: Femoral Hernia with Gangrenous Bowel. *Surgery*, 22:312, 1947.

7. Dunphy, J. E.: Diagnosis and Surgical Management of Strangulated Femoral Hernia. *J. A. M. A.*, **114**:394, 1940.
8. Fergusson, J. D.: A Statistical Investigation into the Results of Surgical Treatment of Femoral Hernia. *St. Thomas's Hosp. Rep.*, **2**:209, 1937.
9. Frankau, C.: Strangulated Hernia: A Review of 1487 Cases. *Brit. J. Surg.*, **19**:176, 1931.
10. Gibson, C. L.: A Study of 1000 Operations for Acute Intestinal Obstruction and Gangrenous Hernia. *Ann. Surg.*, **32**:486, 1900.
11. Hagan, W. H. and J. E. Rhoads: Inguinal and Femoral Hernias. *Surg., Gynec. & Obst.*, **96**:226, 1953.
12. Henry, A. K.: Operation for Femoral Hernia by a Midline Extraperitoneal Approach. *Lancet*, **1**:531, 1936.
13. Herxfield, G.: Hernia in Infancy. *Amer. J. Surg.*, **39**:422, 1938.
14. Jarboe, J. P. and J. H. Pratt: Strangulated Femoral Hernia: Relationship of Contents of Hernial Sac to Clinical Manifestations and Prognosis. *Am. J. of Surg.*, **77**:172, 1949.
15. Jarboe, J. P. and J. H. Pratt: Strangulated Femoral Hernia: Surgical Management. *Surg., Gynec. & Obst.*, **85**:185, 1947.
16. Jenkins, H. P.: Diagnosis of the Acute Surgical Abdomen. *Surg. Clinic of No. Am.*, **36**:113, 1956.
17. Jens, J.: Strangulated Femoral Hernia: Review of 100 Cases. *Lancet*, **1**:705, 1943.
18. Jones, J. D. T.: Bilateral Strangulated Hernia. *Brit. Med. J.*, **1**:583, 1942.
19. Knight, G. C.: Intestinal Strangulation. *Brit. J. Surg.*, **25**:209, 1937.
20. Koontz, A. R.: Femoral Hernia: Operative Cases at the Johns Hopkins Hospital During a 21 Year Period. *Arch. Surg.*, **64**:298, 1952.
21. Laroyenne: Hernies Compliquees d'entranlement Retrograde de intestine. *Lyon Chir.*, **3**:698, 1910.
22. Lloyd, E. I.: Femoral Hernia in Boy of 5 Years. *Brit. J. Surg.*, **18**:657, 1931.
23. Lotheissen, G.: Zur Radikaloperation der Schenkelhernien. *Centralb. f. Chir.*, **25**:548, 1898.
24. Maydl, C.: Urber Retrograde incarceration der Tuba and des Processus Vermiformis in Lersten und Schenkelhernien. *Wein. Klin. Rundschau*, **9**:17, 33, 1895.
25. Mikkelsen, W. P. and C. J. Berne: Femoral Hernioplasty: Suprapubic Extraperitoneal (Cheatele-Henry) Approach. *Surgery*, **35**:743, 1954.
26. McClure, R. D. and L. S. Fallis: Femoral Hernia: Report of 90 Operations. *Ann. Surg.*, **109**:987, 1939.
27. McIver, M. A.: Acute Intestinal Obstruction: III. Obstructions Due to Neoplasms and Strangulated External Hernia. *Arch. Surg.*, **25**:1125, 1932.
28. McNealy, R. W., M. E. Lichtenstein and M. A. Todd: The Diagnosis and Management of Incarcerated and Strangulated Femoral Hernia. *Surg., Gynec. & Obst.*, **74**:1005, 1942.
29. Owen, H. W., J. W. Kirklin and J. W. DuShane: Femoral Hernias in Infants and Young Children. *Surg.*, **36**:283, 1954.
30. Payson, B. F., K. M. Schneider and M. B. Victor: Strangulation of a Merkel's Diverticulum in a Femoral Hernia (Littre's). *Ann. Surg.*, **144**:277, 1956.
31. Peden, J. C. Jr.: Strangulated Femoral Hernia: A Review of 108 Cases. *Missouri State Med. Assn. J.*, **48**:874, 1951.
32. Pfeiffer, D. B. and F. D. Sain: Femoral Hernia with Special Reference to Its Complications. *Am. J. of Surg.*, **83**:767, 1952.
33. Rutherford, R.: Femoral Hernia in Children. *Lancet*, **2**:498, 1927.
34. Shelley, H. J.: Femoral Hernias: A Study of 238 Hernias and 226 Repairs. *Arch. Surg.*, **41**:1229, 1940.
35. Skinner, H. L., G. W. Bolin and G. M. Gordon: Femoral Hernia. *N. Y. State J. Med.*, **53**:1685, 1953.
36. Telle, D. T.: Inguinal and Femoral Hernia: A Review of 1,694 Cases. *Am. J. Surg.*, **93**:433, 1957.
37. Underhill, B. M. L.: Strangulated Femoral Hernia in Infant Boy Aged 5 Weeks. *Brit. J. Surg.*, **42**:332, 1954.
38. Wakeley, C. P. G.: Treatment of Certain Types of External Herniae. *Lancet*, **1**:822, 1940.
39. Warren, K. W.: Hernias in the Poor Risk Patient. *Surg. Clinic of No. Am.*, **34**:769, 1954.
40. Watson, L. F.: *Hernia*, Ed. 3. St. Louis, C. V. Mosby Co., 1948, p. 330.