

Kaiser Permanente Medicine 50 Years Ago: A Review of Our Experience with Hernioplastic Procedures

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In a 21 month period (September, 1942 to May, 1944) 623 hernioplastic procedures (532 patients; 92% inguinal) were performed at the Oakland, CA, Permanente Foundation Hospital, making this the most common major surgical procedure at that facility. Most were considered related to industrial injury; 42 represented recurrent hernias. A modified Halsted technique, under spinal anesthesia (89%), was usually performed. There were no deaths and very few operative complications (3 inadvertent urinary bladder openings). Post-operative minor and major pulmonary complications were common (23%), and not reduced by sulfadiazine prophylaxis. However, there were

no pulmonary complications in a small subset of persons ambulated on the first or second postoperative day. This experience illustrates the importance of this condition and of its management.

Introduction

During the 21 month period from September 1, 1942, to May 31, 1944, 623 hernioplastic procedures have been carried out at this hospital on 532 patients. The types of hernia were distributed as indicated in Table 1.

There were no deaths in this group of operated patients. Since none but inguinal hernioplasties were performed in sufficient numbers to provide significant statistical data, only these will be discussed here.

The importance of the occurrence, or of the aggravation of pre-existing hernias in heavy industry in this state is emphasized by the fact that not only has inguinal hernioplasty been our most frequent major surgical procedure but also the occurrence of inguinal hernias has been one of the most common major industrial accidents during this period in the Richmond shipyards. 329 or 57.8 percent of the 574 inguinal hernioplasties were performed for hernias adjudged by the California State Industrial Accident Commission to have arisen out of or have been aggravated by work in the shipyards.

Statistical Survey

Types of Inguinal Hernia.—574 inguinal hernioplasties were carried out on 483 patients in this period. As may be seen from Table 2, there was a relatively large percentage of direct hernias; 160 or 30 percent of 537 primary inguinal hernias being direct or direct-indirect, as contrasted to the somewhat lower figure of 25 percent which is the prevalent occurrence of direct to indirect hernias in adult males in the general population. This may be attributed to the older age group with which we are dealing (as illustrated in Table 3) as well as to the traumatic factor of heavy work. All of these things, the higher percentage of direct hernias, the older age group, and the heavy work to which our patients must return, contribute to the increased danger of recurrence in our patients over the average and to the necessity for excellence in technique and for choosing the proper operative procedure in any given instance.

Table 1. Analysis of total number of hernioplasties performed

Type	Number	Percent
Inguinal	574	92.1
Femoral	18	2.9
Epigastric	15	2.4
Umbilical	8	1.1
Incisional	6	1.0
Diaphragmatic	1	
Lumbar	1	
Total	623	100

Table 2. Hernial type in 574 operations for inguinal hernia

Type	Number	Percent
Indirect	372	64.8
Direct	95	16.6
Direct-Indirect	65	11.3
Recurrent	42	7.3
Total	574	100.0

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Age Distribution.—271 or 56 percent of patients were over 40 years of age and 146 or 30 percent (nearly one-third of all patients on whom inguinal hernioplasties were done) were over 50 years of age.

Sex Distribution.—14 inguinal hernioplasties were done on 11 women, 13 of these being indirect and one a false recurrence of an indirect hernia. This is a percentage of 2.4 which is rather high in consideration of the proportion of males to females working in the Richmond shipyard.

Relative Frequency of Side Involved.—Direct and recurrent hernias were not significantly more common on one side than the other. However, of the 442 hernias which had an indirect sac, including those of the direct-indirect variety, there were 250 or 55.6 percent on the right side. This is in accordance with the usual statistics and is due to the later descent of the testis on the right side.

Anesthesia.—Spinal anesthesia usually of 50 milligrams of procaine in 20 milligrams of pontocaine is routinely used because of its simplicity and ease of administration. When spinal anesthesia is contraindicated, local infiltration is employed. General anesthesia is avoided as much as possible, and is utilized only in those patients who refuse any other type of anesthesia, or in whom spinal anesthesia is contraindicated and the procedure contemplated is too formidable to carry out under local. Many of our earlier operations were completed under intravenous pentothal or nitrous oxide when spinal anesthesia failed to last long enough. Due to the larger number of pulmonary complications in this group, we now prefer to finish procedures which outlast the spinal anesthetic under local infiltration although it is by no means certain that the length of time that the patient is on the table is not as important as the general anesthetic in producing these complications.

Bilateral Hernia.—There were 91 bilateral hernioplasties performed in this group, of which 53 were done at one operation and 38 were done at separate operations one week apart. Due to the increased number of pulmonary complications in those patients who had a bilateral hernioplasty at one operation and to the probability of a less successful repair when bilateral direct hernioplasties are carried out at once, particularly in older patients and those with poorer structures, it is now our practice to do bilateral operations at separate intervals one week apart except in young men with good structures and small indirect hernias. This decision is made at the operating table.

Table 3. Age distribution in 483 patients operated for inguinal hernia

Age group	Number	Percent
15-19	21	4.35
20-29	85	17.60
30-39	106	21.95
40-49	125	25.67
50-59	99	20.50
60-69	46	9.52
70-79	1	0.21
Total	483	100.00

Table 4. Anesthesia used in 521 consecutive hernioplasties

Anesthesia	Number	Percent
Spinal	465	89.3
Local	45	8.6
General	11	2.1
Spinal supplemented by general	86	16.5

Complications

Operative.—The only operative complication which occurred was the inadvertent opening of the urinary bladder in 3 instances. Two of these were in recurrent direct hernias and the third in an initial operation upon a direct hernia. In 2 cases, the bladder was opened in attempting to dissect huge masses of preperitoneal fat from Hesselbach's triangle. In the third, the bladder had been pulled into Hesselbach's triangle in a previous repair. All 3 were closed with two layers of Lembert sutures of #40 cotton, sulfathiazole powder placed in the hernial wound which was closed in the usual manner, and a retention catheter placed in the bladder for one week to 10 days. Two of the 3 healed with no untoward incident. The third developed a wound infection requiring drainage but the repair remained successful.

Postoperative.—There have been very few postoperative complications, except pulmonary ones, which have been rather high. There were 3 instances of

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Table 5. Postoperative complications in 521 patients

Complication	Number	Percent
Atelectasis (of all degrees)	87	17.70
Pneumonia	24	4.60
Thrombophlebitis	4	0.75
Urinary Tract Infection	3	0.57
Total	118	22.62

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urinary tract infections which subsided promptly with treatment. Catheterization was necessary during the first 24 hours in a rather large group, but this resulted in no difficulty. Thrombophlebitis or phlebotrombosis occurred in four patients who recovered satisfactorily. Minor and major degrees of pulmonary atelectasis were diagnosed in 87 patients, and frank pneumonia with typed pneumococci and diagnostic x-ray findings developed in 24 patients.

Thus 21.3 percent of all patients developed a postoperative pulmonary complication. The older age group of our patients may be partially responsible for this high incidence. In seeking controllable factors which may affect this situation it was found that patients who had preoperative chronic respiratory infections, those who had a bilateral operation done at one sitting and those who had a general anesthesia supplementing their spinal, all had a higher incidence of pulmonary complications than the general average.

In an attempt to combat this hazard, 20 consecutive patients were given 5 grams of sulfadiazine the evening before surgery and 2 grams every six hours following surgery. This gave an adequate therapeutic blood level due to preoperative and postoperative dehydration, but there was no noticeable difference in postoperative fever or pulmonary complications. One patient actually developed pneumococcus pneumonia on this routine, and it was given up.

It has become our policy to avoid operating on patients who have any appreciable chronic respiratory infections; to do nearly all bilateral operations one week apart; to complete prolonged procedures under local infiltration; and not to give preoperative atropine to patients, particularly those with histories of asthma or bronchitis. All the usual measures of carbogen inhalation, deep breathing, coughing, etc. have always been utilized.

Many of our patients have chronic cough, minor degrees of hoarseness, and a chronic rhinitis. Despite vigorous therapeutic measures preoperatively, many fail to respond and surgery is carried out anyway. We have classified this group as patients with chronic respiratory infections. Patients with any evidence of an acute respiratory infection are of course not operated on during the acute episode. However, these precautions still leave us with a dangerously high percentage of pulmonary complications. In consideration of favorable reports from other hospitals, we have abandoned our policy of keeping postoperative hernioplasties in bed 12 to 14 days and have allowed them to sit up on the first and walk on the second postoperative day. The patient is discharged from the hospital on the 9th or 10th postoperative day but is not allowed to return to work before the usual six to eight week period. Although the group of patients treated in this manner is still small, it is significant that as yet there have been absolutely no postoperative complications among them. The patients are usually pleased to be up, and several hospital days are saved in discharging them early. It is not anticipated that any recurrences can be attributed to early ambulation although it will take a long period of observation to determine this.

Wound Healing.—Three wound infections occurred in this series. One occurred on the second side of a bilateral inguinal hernioplasty. This wound healed in the hospital and did not result in expulsion of suture material. Two wound infections occurred in contaminated hernioplasty wounds, one in an incarcerated indirect hernia containing a ruptured appendix and the other in one of the cases in which the urinary bladder was opened. Eleven wounds developed subcutaneous hematomas, but none of these became infected.

Technique and Suture Material

Although a few of our earliest hernioplasties were done with silk, cotton has been used throughout our series. It is in our experience an ideal suture material. No forms of fascial grafts or sutures have been used.

The technique of repair has been uniform throughout since all operations have been done by or directly under the supervision of several closely associated surgeons. A modified original Halsted technique with subcutaneous transplantation of the cord has been the basis of all of our operations with the exception of females. Careful, sharp dissection and meticulous repair has been emphasized, even though

**Table 6. Incidence of pulmonary complications under various special conditions**

Predisposing factor	Number of patients	Patients with pulmonary complications	
		Number	Percent
Preoperative chronic respiratory infection	46	20	43.5
Bilateral operation	53	16	30.2
Spinal plus general anesthesia	86	21	24.6

it may prolong the procedure somewhat. Very high ligation of indirect sacs is facilitated by using eyelid retractors on the internal ring. In the presence of an indirect sac, Hesselbach's triangle and the femoral region are always palpated from within the abdomen. We feel that it is of considerable importance in the presence of an indirect sac to convert all direct hernias into indirect; and further that, even though there is no definite direct hernia but only a peritoneal bulge in Hesselbach's triangle, the peritoneal bulge below the epigastric vessels should be brought above and ligated with the sac. Excess fat is dissected from the cord so that it may be as small as possible in its subcutaneous position, and the rent in the cremaster and spermatic fascia is closed with interrupted sutures. Direct hernias if diffuse may be inverted, otherwise they are excised together with any redundant preperitoneal fat, carefully stripping the bladder from the peritoneum. In cases where there are poorly developed fascial structures or there is a wide defect in Hesselbach's triangle, we have been more and more frequently making a vertical relaxing incision in the inner leaf of the anterior rectus sheath near the midline, two to four inches in length. This frequently allows approximation of fascia to fascia without turning a flap of rectus sheath as in the Bloodgood operation; and, probably even more important, allows a plastic repair without undue tension. We have been sufficiently impressed with the McVay technique that we often suture to Cooper's ligament, but include the inguinal ligament and run our interrupted sutures over, not into, the femoral sheath, utilizing the inguinal ligament quite high to form a new, higher, internal ring. A few sutures are always placed and loosely tied between the conjoined muscle and inguinal ligament above the internal ring. The aponeurosis of the external oblique is then im-

bricated beneath the cord with interrupted sutures. All sutures below the internal ring should be placed not more than one quarter of an inch apart.

The ilio-inguinal and ilio-hypogastric nerves are carefully preserved. Very few complaints of sensory changes have been registered. In carrying out the relaxing incision, branches of the ilio-hypogastric nerve must be dissected free and protected.

Orchidectomies have been performed in 5 instances. This allows the ideal repair of the inguinal region and in some cases offers the only possibility of reasonably good repair. In other cases the advisability of orchidectomy must be weighed against the desirability of increasing the chances of permanent cure. Orchidectomy should be reserved for repair of recurrent hernias in elderly patients with poor structure and occasionally in other instances.

Recurrence

Forty-two recurrent inguinal hernias were repaired, of which 19 had direct and 23 indirect recurrences. Twenty-two had been previously repaired elsewhere by a Bassini, 3 by a Ferguson, and 15 by a modified original Halsted method. In two it was impossible to distinguish by what method they had been repaired.

Although it has not been possible to follow our patients closely and regularly beyond an 8 week period, the fact that most of them are operated on as a result of industrial accidents and that most are still employed at the Richmond shipyards makes it probable that we know of the majority of our recurrences. In addition, many modern authors believe and prove statistically that nearly all recurrences are evident to careful examination within two months following the original repair. Our patients receive careful weekly examinations for this period. The modern general recurrence rate is probably about 8

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percent for indirect and 10 percent for direct hernias within the first year. We have four known recurrences or 0.7 percent. All of these have been reoperated. In a recurrence in a female, there was no actual recurrence but a globule of preperitoneal fat which protruded through the internal ring. The remaining 3 each illustrate common errors in repair. One had a small indirect sac which had not been found at the initial repair of a direct hernia although the cord had been explored. The second had too low a ligation of an indirect sac so that the ligated neck could be felt through the internal ring. The third had a direct recurrence of preperitoneal fat which had not been excised directly over the pubic spine.

There was no evidence of non-absorbable suture in the 42 recurrent hernias operated on. In our own 4 recurrences, there was excellent adherence of all tissues including muscle to fascia, and there was considerably less diffuse scarring than in those in which absorbable sutures had been used.

Commentary

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Dr. Baritell's article on primarily inguinal hernias in the 1944 *Permanente Foundation Medical Bulletin* is fascinating and provides a complete overview appropriate for that time. However, the article contrasts starkly with current teaching in many respects and raises other issues that remain controversial some 55 years after publication.

Nonetheless, one thing has probably not changed substantially: Dr. Baritell reported that inguinal hernioplasty was the most frequent major surgical procedure at the Permanente Foundation Hospital in Oakland. At a rate of about 750,000 cases per year, inguinal hernioplasty is certainly one of the most common surgical procedures done in the United States today. The impact of this procedure on health care resources is substantial, as are the economic issues associated with the resulting disability.

Dr. Baritell reported that "the occurrence of inguinal hernias has been one of the most common major industrial accidents during this period in the Richmond shipyards." Almost 60% of the hernia cases described in the report were judged by the California State Industrial Accident Commission to have arisen from or have been aggravated by work in the shipyards. The author repeatedly emphasized the

Summary

1. A statistical summary of 574 consecutive inguinal hernioplasties in 483 patients is presented.
2. Postoperative complications and their prevention is analyzed.
3. Choice of inguinal hernioplasty and recurrence rate is discussed.

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"traumatic factor of heavy work." Although the "industrial" nature of inguinal hernia persists today to some degree, the reasons are primarily nonmedical. The incidence of inguinal hernia in sedentary workers is now known to be the same as in workers who do heavy manual labor.

Many of us find somewhat disconcerting the fact that Dr. Baritell included "the older age group" as a risk factor contributing to increased danger of inguinal hernia recurrence in his patients. We find this statement disconcerting because this "older age group" consisted of 56% of patients aged >40 years and 30% of patients aged >50 years! By today's standards, these patients would not qualify as the older age group.

Dr. Baritell reported a higher number of pulmonary complications in patients receiving bilateral hernioplasty and referred to "the probability of a less successful repair when bilateral direct hernioplasties are carried out at once, particularly in older patients and those with poorer structures." This finding resulted in a change of practice: Dr. Baritell would do bilateral hernioplasty with one week intervening "except in young men with good structures and small indirect hernias." Surprisingly, the debate over the appropriateness of simultaneous bilateral hernia repair has persisted until recently; tension-free repair should now make the point moot. Until quite recently, some surgeons in my own department would

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not do simultaneous bilateral hernia repair in adults because of the “higher recurrence rate,” which in my opinion has never been conclusively shown.

Of great historical interest is the extremely high pulmonary complication rate, ie, 21.3% postoperative atelectasis and pneumonia for this relatively simple operation. High-risk patients who received spinal and general anesthesia or bilateral hernia repair or who had preoperative chronic respiratory infection had even higher rates of pulmonary complications: 24.6% to 43.5%. Dr. Baritell tried a regimen of prophylactic sulfadiazine preoperatively and postoperatively in these patients but without affecting the pulmonary complications.

Perhaps the most major contribution of the Baritell paper at the time of publication was the reporting of zero complications in a small subset of patients who were allowed to sit up on the first and walk on the second postoperative day, whereas the standard of practice at that time was to require 12 to 14 days of bedrest after hernioplasty. Although the “early ambulation patients” remained in the hospital for 9 to 10 days, the change in practice reduced the pulmonary complication rate to zero regardless of such factors as type of anesthesia and duration of operation. This lesson should never be forgotten but often must be relearned.

In regard to methods of hernia repair, Dr. Baritell described both a modified Halsted technique and the McVay repair, both of which were standard at the time and produced recurrence rates of approximately 8% to 10%. Dr. Baritell reported a recurrence rate of 0.7% but noted that “although it has not been possible to follow our patients closely and regularly beyond an eight week period, the fact that most are still employed at the Richmond shipyards makes it probable that we know of the majority of our recurrences.” Today, we recognize that probably half of all recurrences occur after five years, that the recurrence rate is proportionate to length of follow-up, and that only the grossest technical errors are likely to result in recurrence within eight weeks.

Although Dr. Baritell’s article of more than a half century ago is out of step in many ways with modern herniology, the article is timely inasmuch as it turns our attention to a problem of great current interest because of the variety of repair techniques available. Until about 10 years ago, some type of tissue-to-tissue repair as described by Dr. Baritell was standard for repair of inguinal hernia. “Sew the good stuff to the good stuff”² was the mantra of the hernia surgeon, although surgeons debated what exactly constituted the “good stuff.” All these types of repair resulted in tension, which caused postoperative pain, disability, and recurrence. In spite

of these consequences, specialized centers such as the Shouldice Hospital in Thornhill, Ontario, showed that surgeons with a special interest in hernia surgery could achieve extremely low recurrence rates. The mean rate, however, probably remained in the range (ie, 8% to 10%) quoted by Dr. Baritell.

Lichtenstein and others have advocated the more or less generally accepted current procedure that yields “tension-free repair” by using mesh.³ The procedure can be done open with a plug, as championed by Rutkow and Robbins;⁴ by sutureless plug repair, as advocated by Kugel⁵ or by a laparoscopic approach.

Each of these repairs today is done on an ambulatory basis: most patients are discharged several hours after the operation is completed. Advocates claim specific advantages for each of these methods, which are all tension-free and use mesh. Fears of infection using mesh in the inguinal area have been shown to be unwarranted. However, the procedures differ in several important ways, including the variable learning curve required for doing the operation correctly as well as the appropriate use of resources.

Among the many challenges facing us today, inguinal hernia repair remains one of the most common. Variation in clinical practice of inguinal hernia repair is great and undoubtedly greater than warranted by the data available. I have no doubt that tissue-to-tissue repair is still done and that most surgeons and hospitals do not know their recurrence rate after inguinal hernia repair. In addition, although the cost of laparoscopic inguinal hernia repair is clearly higher than for the other tension-free repair methods, laparoscopic inguinal hernia repair is still done without any proven advantage that outweighs the increased cost. Decreased pain and earlier date of return to work (usually within a maximum of two weeks regardless of type of job) are routinely achieved by using any of the tension-free repair methods. I hope Dr. Baritell’s article and these comments will stimulate review of outcome measures so as to form the basis for recommending a “best practice” for inguinal hernia repair. ❖

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