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The Etiology of Inguinal Hernia
and
Its Relation to the Employers of Labor

E. Scott Hill

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Introduction

The etiology of inguinal hernia is the most important phase of hernia at the present time, because of importance it assumes in cases seeking compensation for an inguinal hernia.

In endeavoring to explain the etiology it has been necessary to describe the development of the inguinal structures and the descent of the testes, because of their direct bearing on the etiology. The anatomy of the inguinal region is taken up as a basis for which to establish an explanation of the mechanism of hernia. I have explained the incidence of hernia and classified it, and divided inguinal hernia into traumatic congenital and acquired in order to differentiate the etiology of these commonly spoken of types. I have added the contributing causes not because they are essential but because they do play a part. The case reports are added as examples of problems confronting the surgeon in care of inguinal hernia. In the conclusion I have stated my own beliefs as to the etiology of inguinal hernia, according to the knowledge I have gained from the literature on the subject.
History

The subject of hernia and the evident controversy over its causes is an interesting story dating back earlier than the beginning of the Christian era. It has competed and ranked highly among other subjects of medical interest, for study by students of medicine. The history of hernia traveled a chaotic pathway and progress in its study has been shamefully hindered, as has all other medicine at sometime by superstitious ignorance.

History records a Phoenician statuette about 900 B.C. showing a double inguinal hernia.

Celsus who lived in 200 B.C. was the first man to operate for inguinal hernia. He was a Roman and gained much from his dissection of executed criminals. He wrote one of the earliest papers on hernia and manifested his belief that hernia has two causes—relaxation and rupture. The relaxation cases he said should be reduced and the rupture cases operated. He in his military work isolated the sac through an incision and ligated it without opening the sac. Celsus gained his ideas from Archegenes, a Greek writer who lived long before him. These ideas held for almost two thousand years.
Galen, who lived shortly after Christ accepted the ideas of Celsus and Archegenes. He described the iliac fascia and Paupart's ligament and brought out the difference between testicular and funicular hernia. He maintained three causes for hernia: predisposing, antecedent and immediate. The ideas of Celsus still prevailed during the middle ages, but operation for hernia fell into the hands of traveling mountebanks during this period, remaining there until the time of Gui De Chaulias in the fourteenth century. In the sixteenth century during the rise of anatomy there was little advancement although three men, Sylvius, Vesalius, and Fallopius, all considered very brilliant students did much work on the subject during this period.

Fabricius and Mary, early in the eighteenth century, contributed the next great work in the operation for hernia. Benevoli in 1797 declared that a previous lengthening of mesentery was necessary to the formation of hernia. Their belief was denied in 1821 by Scarpa who was considered one of the greatest surgeons of his time. He offered the theory of intra-abdominal pressure with counter pressure of the abdominal walls, and said that hernia was the result of disproportion in these two
opposing forces. He believed that through the action
of these factors the hernia appeared at the weakest
point in the abdominal wall.\(^{(2)}\)

What is probably the greatest contribution to
the subject of hernia is the work of Sir Astley
Cooper, published in 1804 to 1807. During his whole
life as a physician he dissected from six to eight
o'clock every morning. He studied the cadavers of
a large number of male infants and little boys and
was the first man to establish the correct idea of
the small open funicular canal and its gradual dilata-
tion by the omental wedge, to the formation of
inguinal hernia. The atlas which Sir Astley Cooper
published is famous among surgeons for its complete-
ness and the beauty of its plates.\(^{(2)}\)

Basini late in the nineteenth century struck
the keynote from an operative standpoint but it re-
mains an interesting fact that the work of Celsus
and the beliefs of Archegenes who lived more than
two thousand years previous, established the founda-
tion on which our present knowledge of hernia now
rests. The surprising feature in the history of
hernia is not the progress that has been made, but
the slowness of the medical profession to grasp and
understand the facts that have been brought out.
In the subject of hernia as well as many other subjects its history and progress are interwoven with the romantic advancements which make it a broad subject of panoramic scope. It was dependent on Listers development of antisepsis in 1865 to 1890, on the surgical skill of such men as Basini of Italy, Halstead of America and McEwen of Scotland.
Incidence and Classification

In the consideration of the etiological factors of inguinal hernia it is necessary, in order to establish a working basis, to consider the incidence of hernia, to classify the different types, and to survey the entire scope of the problem.

Inguinal hernia occurs many times more frequently in males than in females. In a report of nine hundred seventy-eight cases by Hamilton Russell of Melbourne Australia, nine hundred ten of the cases were males and sixty-eight were females. Alfred H. Iason in a report of thirty-eight cases listed thirty-six males and two females. It is difficult to estimate the ratio of incidence between the two sexes as most reports of series of cases are taken from industrial groups and females are not taken into consideration. The general consensus of opinion among men who have investigated and written on the subject is that less than ten percent of all inguinal hernia occur in females.

Inguinal hernia are more frequent on the right side than the left. Approximately sixty percent are on the right. Russell in his report of nine hundred sixty-eight cases, reported six hundred nineteen on
the right side two hundred twenty-four on the left side and one hundred twenty-five on which were bilateral. J. C. Hubbard in a report of two hundred twenty-six cases lists one hundred twelve on the right, seventy-six on the left and sixty bilateral. Alfred H. Iason in a report of forty-eight cases lists sixteen on the right side, eighteen on the left and four bilateral. J. C. Hubbard in discussing the frequency of bilateral hernia reports the twenty-five percent of the cases he has operated originally had bilateral hernias and twelve percent of those operated for unilateral hernia returned in from one to four years for operation on the opposite side.

In the classification of inguinal hernia, one may find almost as many different classifications as there are authors who have written on the subject. Classification is necessarily an important phase in the consideration of etiology and any competent classification should be made on the bases of etiology.

The primary step in classification is the differentiation between direct and indirect. In separating hernias into these two classes we find that ninety-eight percent of all inguinal hernia are indirect and that the subject of hernia therefore prac-
tically becomes a consideration of the indirect or oblique variety.

The indirect inguinal hernia, enters the internal ring, follows the inguinal canal, emerges through the external canal and may descend into the scrotum.

The direct hernia comes through Hesselbach's triangle, emerges through the external ring, but is prevented from descending into the scrotum by intravention of the spermatic cord and the structures surrounding it. This form results from some abnormality in the conjoined tendon; if this tendon is too narrow the hernia appears laterally and if too lax the hernia pushes it ahead and it becomes one of its coverings; if defective the hernia may appear through the defect. The important point to be born in mind relative to direct inguinal hernias is that the congenital phase concerns the abdominal wall and the acquired phase the sac, while in the indirect hernia the congenital phase concerns the sac and the acquired phase the abdominal wall. The last statement made concerning indirect hernia is not true in all cases as will be pointed out later.

Further classification of the indirect type has occupied a great deal of attention and been under-
taken from several different view points. F. William Shafer in a discussion of hernia states that hernia are most commonly classified as congenital and acquired or traumatic, and that the congenital hernias are further divided into, congenital, infantile, funicular and encysted depending on the type and extent of the sac. He believes that such a classification is entirely inconsequential since the type can never be demonstrated practically in operative procedures.

Hamilton Russell classified hernias with a congenital preformed sac into three groups as follows:

Group A: Included in this group are those hernias in which the processus vaginalis is normal in shape. He further subdivides this group as follows; (1) Total, in which the processus vaginalis is patent through out its entire length; (2) partial or funicular, which are the result of imperfect obliteration of the funicular portion of the processus vaginalis.
Group B: Included in this group are those in which the sac is distorted by implication of its funicular portion in the abdominal wall with lateral saeculation and interference with descent of the testes.

- Preperitoneal hernia
- Intermuscular hernia
- Superficial inguinal hernia

Group C: Included in this group are those in which the sac is distorted by implication of its testicular portion in the abdominal wall.

- Magna
- Infantile
- No hernia
- Potential hydrocele

In his discussion of inguinal hernia, he states that from an etiological standpoint inguinal hernias are divided into two groups; the congenital or intra-funicular, and the acquired or extra-funicular.

Group I. Congenital inguinal hernia is always of the oblique variety and the sac is found
initimately adherent to the vas deferens and to other cord structures.

Group II. Acquired inguinal hernias comprise all direct hernia, traumatic hernia through the external inguinal fossa, and those that escape through the vent in the transversalis fascia. In acquired hernia the sac is not adherent to the vas deferens or other cord structures and it may be some distance away.

John J. Morehead classifies indirect inguinal hernia into four degrees.

First degree hernia means that the ring is dilated enough to admit the index finger tip and an impulse is present.

Second degree, means that the ring is still further dilated and a palpable mass appears at the ring.

Third degree, means that all the other elements exist as in second degree and in addition there is a visible mass at either ring or along the canal.

Fourth degree, means that the mass enters the scrotum.

Charles A. Leuffer classifies open inguinal rings very conveniently as follows:
Class I. The external ring admits the little finger easily and stretches easily. There is little or no perceptible impulse seen or felt on coughing and no weakness at the internal ring felt on direct pressure.

Class II. The external ring may or may not be larger than the first class but the internal ring shows a spot of less resistance on direct pressure, about the size of the middle finger and there is a slight impulse seen and felt on coughing.

Class III. The external ring may be so large as not to be found but may be small and tight, but the internal ring easily admits the finger or thumb and shows marked bulging on coughing. Rings of this class are border line cases and are potential hernias. (19)

Alfred H. Iason in an article on indirect inguinal hernia classifies them as follows:

I. Congenital

A. (1) Incomplete where due to partial failure of closure of the funicular process the hernia can not pass into the testicular portion of the tunica vaginalis.

(2) Complete where due to total failure of closure, the hernia is free to pass into the testicular portion of the tunica vaginalis.
B. Interstitial where often with an incomplete descent of the testis a portion of the funicular process is caught by some layer of the abdominal wall, thus permitting the insinuation of the sac between any two layers.

II. Infantile: In this type the funicular process has been closed but due to faulty agglutination, the increased abdominal tension tends to extrude the contents into the incompletely obliterated sac thereby forming a hernia during infancy. It really is a congenital hernia which is late in appearing. Lason further states:—"In all cases where hernia is not noted until late in life, it probably is one of the infantile type, the hernia formation awaiting the propitious incident when the strain arrives. In those children in whom a hernial protrusion is cured without operation the condition is probably one of the latter or infantile type, in which the agglutination process completes itself or rather becomes firmer with age, and the muscular development prevents the growth of what is really a slight protrusion at the abdominal and inguinal ring."

F. William Shafer believes that the division of inguinal hernia into two distinct classes; congenital and acquired which is common to most text books
is erroneous, and that one class, congenitally acquired, would suffice. He further states that his reason for such a classification is based upon his conviction that the only factor necessary for development of hernia is one of two conditions; the presence of a preformed sac or the absence of normal development of the region.
It was for many years accepted as an established fact that the mesenephros, ovary and testis, glide downward from their original positions into the true pelvis. However, from study of the development of the mesenephros and the indifferent sex glands, this has been disproven. The descent of the mesenephros, of the ovary and the internal descent of the testis to the inguinal canal does not take place, but the testis does wander from the abdominal cavity into the scrotal sac. The anlagen of the mesenephros and reproductive glands extend from the diaphragm to the true pelvis. When their growth in length is completed their caudal ends become stationary. What seems to be a descent of the organs is caused by their degeneration in their cranial ends, thus producing a shortening of the entire organ and an apparent downward displacement of their cranial ends. While this degeneration is proceeding the anlagen themselves are still proceeding in growth caudally. It is by this process that the testis progress from their original position in the kidney region to a position just proximal to the internal inguinal ring. We now have only
to consider the external descent of the testis.

In both sexes the crista inguinalis, which is situated on the posterior surface of the anterior abdominal wall, is united with the urogenital fold by the inguinal fold, thus forming a bridge between the urogenital fold and the entrance to the inguinal canal. From the beginning there is a cord of compact mesenchyme in the interior of the crista inguinalis which develops into the chorda gubernaculi. This cord of mesenchyme is evident even before there is any indication of differentiation of the abdominal musculature. It is conical in shape in transverse section, the apex being toward the crista inguinalis and the base almost at the integument. In the development of the abdominal musculature the developing muscles grow around the chorda gubernaculi, and a canal is necessarily formed. This is the inguinal canal. Its contents were present from the beginning. The transversus and the obliquus internus muscles give off fibers to the chorda gubernaculi, which bend around and accompany it to the crista inguinalis. These fibers go to make up a mantle that is formed around the chorda gubernaculi, which is known in comparative anatomy as the conus musculosus inguinalis.
At the position corresponding to the base of the chorda the obliquus externus muscle presents at first a distinct foramen. Through this foramen the chorda gubernaculi makes connection with a second mesenchymatous cord, the ligamentum scroti, which extends from the outer opening of the inguinal canal to the integument and to the base of the genital tubercle. The aponeurosis of the external oblique grows around the ligamentum scroti, and forms a thin hernial sac, which becomes the fascia cremasteria. This is not a true fascia but in reality an aponeurosis. The union of the gubernaculum with the mesonephric fold is exactly opposite the insertion of the ligamentum testis. Another mesenchymatous cord develops in the mesenephros between the two insertions which connects both with the ligamentum testis and the gubernaculum testis. Thus on completion of this union there is a continuous cord extending from the lower pole of the testis through the inguinal canal and terminating in the integument at the base of the genital tubercle. Thus we have formed the chorda gubernaculi. The pars scrotalis streams out into the subcutaneous connective tissue of the genital swellings and thus anchors itself. The chorda gubernaculi marks the path, which the testis must
traverse in its descent from the internal inguinal ring into the scrotum.

The Formation of the Saccus Vaginalis.

The saccus vaginalis is a part of the general body cavity, that becomes completely cut off from the rest of the cavity, by the formation of the anterior abdominal wall. The general body cavity in the 19.4 m. m. embryo may be divided into an upper broad portion and a lower portion, the primitive true pelvis. Projecting from the posterior wall in the latter is the rectum, from the right and left walls the urogenital folds and from the anterior wall the vesico-urethral anlage with the two umbilical arteries. The union between the urogenital fold and the anterior abdominal wall is at the boundary of the true pelvis. The following two processes bring about a change in the above described relations: (1) the bringing into the upright position of the anterior abdominal wall, and (2) the taking into the body cavity of the loops of intestines that lie in the exocoelom. By these two processes the anterior abdominal wall becomes separated from the posterior wall, and the sagittal diameter of the abdominal cavity is enlarged. The mesonephric fold is attached to the anterior abdominal wall by
the gubernaculum and the testis is attached to the mesonephric fold by the mesorchium and the epigonal portion of the genital fold. The mesonephric fold and the testis therefore become separated from the posterior wall in order to follow the anterior wall. Thus the long axis of the testis changes from a vertical to a horizontal position and the caudal pole of the testis becomes directed ventrally.

With the bending of the anterior abdominal wall into the upright position there is a pull exerted on the umbilical arteries and this pull on the horizontal portions, which run along the boundary between the false and true pelvis increases the height of the peritoneal folds covering them. These folds rising from below form a partition between the primitive true pelvis and the anlagen of the saccus vaginalis marking them off from the true pelvis. They now appear to be an evagination of definite outline, but are really a portion cut off from the general body cavity by encroachment of the neighboring parts.

The testis gubernaculum and mesonephric fold all lie in the region of the saccus vaginalis and the surfaces of the uregenital fold and gubernaculum
fuse with the lateral wall of the saccus. The lumen of the saccus then disappears on the lateral side and remains only on the medial side. Therefore we may maintain that the alleged invagination of the saccus vaginalis into the abdominal wall is certainly not at first an invagination. There is marked thickening of the abdominal wall, but the thickening does not affect the point at which the gubernaculum passes through the wall. It may be said that the abdominal wall grows around the saccus vaginalis and a groove appears in the wall for its reception.

It is known that the vaginal process passes through the musculature and descends below the former genital swelling but how this is accomplished has not yet been determined. The testis wanders through the inguinal canal during the seventh month of fetal life and becomes evaginated into the saccus vaginalis.

After completion of the descent of the testis the saccus vaginalis is connected with the abdominal cavity by a narrow canal, which shortly after birth becomes a solid cord and is then resorbed. The saccus vaginalis which is then completely cut off from the abdominal cavity becomes the tunica vaginalis.
propria testis. The obliteration takes place at two points, first at the internal ring and a little later at a point just above the epididymis. The small fibrous cord which is formed by the obliteration of the canal may remain and if it does is easily recognized during dissection or operation.

There all possible variations in the obliteration and degeneration of the narrow canal between the abdominal cavity and the tunica vaginalis. Parts of it may remain unclosed. If the opening into the abdominal cavity remains unclosed, there is a predisposition to oblique inguinal hernia. A persistence of the entire canal leads to congenital inguinal hernia.
The Importance of the Preformed Sac in the Causation of Indirect Inguinal Hernia

The formation of the processus vaginalis and its tendency to remain patent in part or all of its length has been discussed in the section on embryology. The presence of the patent processus vaginalis or the preformed sac as it is called in cases of hernia, is the most important single factor in the etiology of indirect inguinal hernia. Hamilton Russell of Melbourne Australia, definitely established this theory in 1889. He published the statement at that time that all inguinal hernias in both adults and children were congenital in origin and were due to persistent patent funicular processes. He demonstrated that all degrees of patency may be encountered as well as variations in the shape of the sac. He has cited as proof sixty hernia operations in children and infants in which the only procedure was obliteration of the sac. Since that time Russell's statement has been modified somewhat and other etiological factors have been realized.

In order to establish the importance of the patent processus vaginalis in the causation of inguinal hernia it is necessary that we determine the preval-
ence of this sac. This may be done in two ways. The first and most important method is considering the results obtained by dissection of cadavers. The second is the evidence the sac presents at operation that it has been present at birth. There is a great deal of controversy, as to whether or not it is possible to say whether or not the sac is congenital or acquired. Methods of differentiation between the congenital and acquired sacs will be discussed later.

There can be no doubt that if the evidence from examination of the dead be received, that hernia enters the patent funicular process in the minority of instances in which it remains open. That is to say hernia does not occur with as great a frequency as the patent processus vaginalis is found in dissection of cadavers. Due to this fact we must grant that the patent sac is not the only factor in the causation of hernia.

Camper in 1875 in a series of dissection in infants found the processus vaginalis open on a single side in thirty-one and five tenths percent of cases and on both sides in forty-five percent. Fere examined seventy-two infants and found an obliteration of the funicular process in thirty-two cases. Keith stated that in children three to four months old the
processus vaginalis is open in thirty to forty percent of all cases. In infants under four months old Sachs found obliteration in forty-one percent and permeability in thirty percent. After the fourth month the percentage of closures was higher, obliteration sixty-nine percent, permeability forty percent. Ramonede examined two hundred and fifteen adult subjects and found abnormalities of the processus vaginalis in fifteen percent.

In 1817 Cloquet, a French anatomist, in the course of five hundred dissections found a depression at the lower border of the internal ring with more or less bulging of the peritoneum. He called this "the infundibuliform process," and found it so often that he thought it a normal condition. We know now that he found an open processus vaginalis.

R. W. Murray in the dissection of one hundred unselected adults without history of hernia, twenty-one had a potential hernial sac, that is a patent processus vaginalis; seven had more than one sac; and one had four. Later he dissected two hundred bodies; forty-seven had patent sacs, often multiple so that there were sixty-eight in all.

Fondler, Wrisberg, Sachs and Enderlin have shown that in seventy percent of new born male in-
fants the processus vaginalis is still open.

Benerjeou stated that the vaginal process is not obliterated in fifty-nine percent of children under four months or in forty-four percent under five months of age.

In the above discussion I have endeavored to establish the fact that the congenital preformed sac or patent processus vaginalis does occur and may be taken into consideration as a factor in the etiology of indirect inguinal hernia.

A hernia is made up essentially of three parts: (1) the sac, (2) covering of the sac, (3) the sac contents. The covering of the sac consists of the normal tissue immediately covering the site of hernia. The sac contents may vary at different times according to the nature of the viscera which happens to be in close proximity to the opening of the sac at the time of the sudden increase of intra-abdominal pressure.

The sac and its origin is the matter under contention. The sacs are classed broadly as prenatal in origin or acquired. There is much disagreement as to whether or not the congenital sac can be differentiated from the acquired sac, but several methods for doing so are mentioned in the literature.
Coley in describing the sac in a case at operation says: "The sac was undoubtedly of congenital origin, extending well into the upper scrotum, two and one half inches long and two inches broad, considerably thickened and firmly adherent to the cremaster muscle.

William Hessert says: "To recognize a congenital hernial sac notice the following characteristics: (1) glove finger-like and narrow sac generally empty; (2) thin wall; (3) absence of subserous fat; (4) trabeculated structure; (5) annular constrictions which oft times still correspond to the internal and external rings; (6) thickening of the fundus; (7) fibrous process extending downward from the fundus for a variable distance sometimes attaching to the tunica vaginalis testis; (8) close relationship of the sac to the vas deferens and spermatic vessels. The latter may be spread over the sac; (9) sac still enveloped by fibers of the cremasteric muscles.

Woolsey says: "The small thin empty sac is not necessarily a recent one, nor does its length indicate other than the extent of its obliteratorive process. It requires the presence of hernial contents to produce the thickening usually associated
Murray states that in congenital hernia the different parts of the sac can be distinguished, the mouth, the narrow neck, and the body, but in the acquired type there is no neck and the mouth opens directly into the body.

Iason in quoting Ogilvie says: "Practically at operation, two varieties of sac are familiar to the surgeon. (1) The common type lies anterior to the structures of the cord: In transverse section the lumen of the sac would resemble a horse-shoe, the cord being invaginated into it as a mesentery. (2) The other is the flat sac, whose walls and rounded fundus are clear to the eye with no preliminary dissection, which lies loose among the vessels and which can be isolated with extreme ease.

Type one is certainly derived from a patent processus funiculares; type two has begun as a traction pouch of parietal peritoneum and is probably acquired on a congenital defect as a basis.

"Hertzler remarks that one of the strongest evidences of the sac being preformed is afforded by an examination of the connective tissue at the point of union of the sac and cord. Microscopic examination will show an interlacement of fibrils running with old hernia."
parallel to the walls of the sac and continuing
over the cord but separated entirely from the sur-
rounding tissue. In several hernias of less than
five days duration, microscopic examination showed
that union of the sac to the cord was made up fully
developed fibrous tissue free from cellular infil-
tration.

It seems that most authors have disregarded the
fact that an acquired sac may be one to several years
old before it is operated and thus there has been an
opportunity for its walls to become thickened and for
fibrous adhesions between it and the cord to become
mature. There is, however, a point that has been
demonstrated to me that has not been brought out by
any of the authors I have read and that is; when the
processus vaginalis does close off at the internal
ring, and an acquired sac is formed later the point
of closure may be definitely felt as a thickenig
in the peritoneum at the medial side of the internal
ring. This is true because in the formation of the
acquired sac by gradual bulging out of the peri-
toneum, the original point of closure is stronger
than the surrounding peritoneum and is not stretched
out but remains in place.

In the anatomy of indirect inguinal hernia, the
hernial sac whether of congenital or acquired origin is always found in front of the spermatic cord, vessels and testicle, in the same exact position and relation as are the admitted congenital hernias. (33)

The fact that a larger proportion of individuals are ruptured during the first year of life than at any other age period, is conclusive evidence of the importance of the congenital sac in the causation of indirect inguinal hernia. During this age there is no occupational or physical hazzard that can cause the protrusion and the patency of the sac and lack of development of the abdominal muscles are the only apparent factors.

The congenital saccular theory of Hamilton Russell based upon the anatomical and pathological findings and supported by the result of excision of the sac is to-day accepted by most surgeons. Objection by some to this theory on grounds that there is no explanation for the delay of development till puberty or later, and that following sudden descent of the bowel into the sac some symptoms of strangulation with bruising and tenderness would be present. Therefore it accounts for the acute form but not the symptomless form where a reducible hernia arises after some trivial accident, with only a feeling of
something giving and a fleeting pain. Many have contended that such an onset as the latter is impossible and that the accident has merely served to draw attention to a previously existing hernia. Hammond says: "Symptomless onset is not uncommon at any age. In children the sudden descent of the bowel into the scrotum without strangulation or bruising is often seen. During the "World War" such an onset was frequent even in well developed men; apparent cause being a slip at drill or stumble in trenches. As the hernial regions were carefully examined at medical inspections, the probability of gradual onset can be excluded." Hammond reports three cases two cases in the same battalion as he in the World War, who developed hernia shortly after inspection by himself. In each case there was a slip while carrying a load and in neither case did nausea or vomiting accompany the onset and the hernia, which was not tender could be easily reduced. He says: "Such a history is not uncommon in civilian life when there is no question of compensation."
Acquired Hernia

The term acquired hernia includes those hernia in which the sac is not of the congenital funicular variety but is one that has been gradually produced by a pouching out of the peritoneum at the internal ring. In order to properly understand the factors involved in an acquired hernia it is advisable to review shortly the anatomy of the structures in the inguinal region that are involved in the hernia formation. By explaining this anatomy and the mechanism of hernial formation I will establish the fact that the acquired hernia are acquired on a congenital basis.

Anatomy of the Inguinal Region.

The inguinal canal is an oblique opening situated parallel to the inner half of Poupart's ligament and a little above it. Directed downward and inward it extends from the internal abdominal ring to the external abdominal ring. It is approximately one and one half inches long in the male and two inches long in the female. After the descent of the testis, the canal contains, the ilio-inguinal nerve, the genital branch of the genitof-crural nerve and the spermatic cord. In the female it
contains the same two nerves and the round ligament. The anterior and posterior walls of the canal run obliquely downward inward and forward and lie in apposition, except for the space occupied by the cord.

The canal is bounded in front by the aponeurosis of the external oblique through out its entire length and by the lower fibers of the internal oblique at its outer third; behind by the triangular ligament of the abdominal wall, at its inner end and by the conjoined tendon and transversalis fascia; above by the arched fibers of the internal oblique and transversalis muscles; below by Poupart's ligament, as far as the posterior shelving margin which gives attachment to the transversalis fascia and at its inner end by Gimbernat's ligament. Many anatomists describe three enforcing fascias, i.e., the ligament of Henle, the ligament of Hesselbach and the ilio-pubic band.

The external, superficial or subcutaneous abdominal ring is an opening in the aponeurosis of the external oblique, located just above and to the inner side of the os pubis. It is oblique in direction, triangular in shape usually measures one inch from base to apex and one half inch from side to side.
It is bounded below by the crest of the os pubis; above by the curved intercolumnar fibers which pass across the upper angles of the ring to increase its strength on either side of the margins of the opening in the aponeurosis which are called the columns of the ring. The normal external ring will seldom admit the tip of the little finger and it is impossible to palpate the inguinal canal or the internal ring. When the external ring is large the cremaster muscle is well developed, apparently an attempt of nature to make up for the weakness in the aponeurosis of the external oblique.

The internal or deep abdominal ring can be located on the external abdominal wall by a circle three fourths of an inch in circumference, placed about three fourths of an inch above the middle of Poupart's ligament. It is an oval opening in the transversalis fascia midway between the anterior superior spine of the ilium and the symphysis pubis. It is bounded above and externally by the arched fibers of the transversalis muscle and below and internally by the deep epigastric vessels. From the circumference of the internal ring a thin funnel shaped membrane, the infundibuliform fascia, continues around the cord and testis, enclosing them
in a distinct pouch. This fascia constitutes one of the coverings of the oblique inguinal hernia. The internal abdominal ring is located in extraperitoneal fatty tissue.

The conjoined tendon of the internal oblique and transversalis muscles is triangular in shape with its base inserted into the crest of the pubis and the pectineal line. It is situated immediately behind the inguinal canal and external ring, thus protecting a weak place in the abdominal wall.

Blake dissected twenty-five normal muscular subjects and found no instance where the conjoined tendon extended more than five eighths of an inch laterally from the insertion of the rectus muscle. In the majority it was less than one half inch and in some it was inappreciable.

Each half of the inner surface of the anterior abdominal wall, in the inguinal region, presents three distinct fossae which are of clinical interest, in the study of the relation of the parietal peritoneum to the different varieties of inguinal hernia. They are: (1) The internal inguinal fossa bounded internally by the median cord (plica urachii) externally the obliterated hypogastric artery and below by the bladder direct hernia may occur through this
fossa but it is very rare. (2) The middle inguinal fossa is bounded internally by the obliterated hypogastric artery; externally by the deep epigastric artery; and below by Poupart's ligament. As a rule direct inguinal hernia make their exit through this fossa. (3) The external inguinal fossa is the small depression in the peritoneum, just to the outer side of the deep epigastric artery, which marks the internal opening of the internal ring. The spermatic cord leaves the abdomen through this ring and is the route taken by indirect inguinal hernia.

The Mechanism of Hernia.

The obliquity of the inguinal canal is the natural obstacle to hernia, because an increase of intra-abdominal tension forces the inguinal walls more firmly together. When a patient strains the conjoined tendon and transversalis contract vigorously and if a finger is inserted into the canal it is gripped between the conjoined tendon and Poupart's ligament. Keith stated that intra-abdominal pressure is raised to 100 m. m. of mercury, by straining of lifting. True acquired hernias or acquired congenital hernias usually follow a sudden increase in intra-abdominal tension, which is sufficient to overcome the resistance offered by the valve like action of the inguin-
al canal. The importance of malformation of the pillars of the external ring, as a predisposing factor is generally unappreciated. Marked phimosis may possibly have an influence in some cases.

There is normally room in the peritoneal cavity for all viscera. Descent of the diaphragm or contraction of the abdominal muscles causes slight raise in the pressure on the walls. At such times the protrusion of the viscera is prevented by the resistance of the peritoneum and fascia supported when necessary by the action of the overlying muscles. When the diaphragm descends the canal is protected by the valvular arrangement and by the action of the inguinal sphincter when the muscles contract. With inspiration the pressure which is first directed downwards and then downwards and outwards closes the canal from within outwards. As the pressure of the posterior against the anterior wall is always equal to the pressure upon the internal ring, there will be no tendency to protrusion of viscera. Since the inguinal sphincter is part of the musculature of the abdominal wall it contracts with the muscles of the wall and since the rise in pressure is secondary to the contraction of the mus-
cles it is obvious that there contraction of the sphincter before there is any strain upon it.

It is possible that during severe prolonged strain the sphincter may be overcome and the internal ring exposed to the pressure above.

The strength of the inguinal canal is dependent upon the action of the neighboring muscles which may become incoordinated. For instance, when the weight is lifted from the ground the legs are firmly fixed, the abdominal muscles contract and the internal ring protected, the giving way of either leg might lead to incoordination of the muscles and consequently a relaxation of irregular contraction of the sphincter at a time when abdominal pressure is raised.

The internal ring will be exposed by pressure from above only if the latter is sufficient to overcome the sphincter or if some incoordinated action of the inguinal muscles takes place. Such an exposure is only momentary and would not be followed by protrusion of viscera since sudden stretching of the peritoneum is not likely. But with a persistent patent funicular process present the bowel might enter the sac. It would be arrested at the apex of the sac or possible at the external ring.
Watson says: "Once the internal ring relaxes or enlarges, and a tongue or wedge-shaped piece of omentum gains an entrance, it is an easy matter for the mass to dilate the internal ring to a point where it has no ability to come back or regain its tone, and the protection of the semispincter action of the internal oblique and transversalis muscles and Poupart's ligament is lost. Once past the internal ring, the hernia rapidly dilates the inguinal canal on its way to the external ring. (34)"

Shafer believes that muscle plays the least part in the development of hernia; that fascia is the most and tendons are next in importance. Therefore congenital defects is always a part of the picture and without this there can be no hernia. The intra-abdominal fat not only increases the intra-abdominal pressure, but this semi-fluid fat is easily influenced by pressure and readily protrudes at any weakened place in the abdominal wall. (32)

In all oblique inguinal hernias the compensatory strengthening of the abdominal walls usually prevents the laborer from developing hernia more frequently than a clerk. Thus we may establish two opposing forces in the development of hernia; (1) Intra-abdominal pressure; (2) the resisting abdominal walls.
In the normal individual this resistance is enough to meet the ordinary pressure plus a margin for periods of greatly increased pressure such as cramps, straining at stool, childbirth, coughing, sneezing, jumping, lifting, gaseous distention, etc. It is evident that whenever this margin of resistance is exceeded by the intra-abdominal pressure, a hernia results. This disproportion between pressure and power of resisting wall may be brought about in two ways: (1) By increase of pressure without compensatory strengthening of wall; (2) by weakening of wall without corresponding fall of pressure.

There can be no denying of the fact, that at the internal ring there is a possibility of a persistent congenital structure. The controversy, as it may be seen is over what factor is responsible for the further development of the sac into a definite clinical hernia. Keith says: "It is not (12) continued degrees of high intra-abdominal pressure but minor and oft repeated impulses that produces the hernia."
Traumatic Hernia

The old English term, rupture, which means a tearing asunder of the tissues, is largely responsible for the traumatic theory of hernia and should be altogether discarded. The term gained its foothold before operation for radical cure of hernia came into general use and before the etiology of hernia was generally known. Since the traumatic theory of hernia, although not recognized by authorities on the subject as having any true relation to the etiology of inguinal hernia, is still fixed in the minds of many men in the medical profession and the laity, it must be discussed here.

A traumatic inguinal hernia is a surgical curiosity and so rare that many men who have written on the subject say they have never seen a case and believe it does not occur. Trauma means injury, inguinal means location and hernia means a protrusion of some part or parts of an intra-abdominal viscus. Therefore a protrusion in this location through an injury means laceration or avulsion of the tissues, with hemorrhage and exudation associated with all the signs and symptoms of an injury. A traumatic hernia may occur anywhere in the abdominal wall,
most likely at its weakest point but usually not at a normal hernia opening, seldom as a direct hernia and never as an indirect inguinal hernia.

W. B. Coley says: "We would define traumatic hernia as a hernia resulting from the direct application of force to that portion of the abdominal wall at which the hernia appears, or a hernia resulting from indirect application of force, causing greatly increased intra-abdominal pressure." (2)

Bilfinger believes that a true traumatic hernia should fulfill the following conditions: (1) "The hernia must be completely developed immediately after, or at least within a very few days after the receipt of the injury." (2) "There must have been no predisposition to hernia no matter of what nature; thus no latent hernia, no empty hernial sac." (2)

"Whether the hernia follows the natural openings in the abdomen, inguinal or crural canals, or creates a new passage-way is immaterial." Bilfinger quotes the opinions of Rose, Voenig, Socin, and others, all of which agree that the sudden development of a hernial sac is impossible or contrary to experience. (2)

F. W. Leigh says: "A true traumatic hernia or rupture may appear suddenly, following injury or
violence, which causes great increase in intra-abdominal tension.

Many writers state that a recent hernia is tender and painful on manipulation and echymosis is not infrequently present. This statement is not uncommonly found in textbooks and in articles on traumatic hernia. W. B. Coley says: "We believe it has no basis in fact." "In an experience of 31 years at the hospital for "Ruptured and Crippled," where we have an average of five thousand new cases a year, there has not been a single case of recent hernia, which was tender, painful and accompanied by echymosis in which there had been a history of antecedent injury or accident of any form."

Ross A. Woolsey, states his belief that the double or bilateral hernia is incompatible with the idea of hernia by force. He goes on to say that Coley, Leigh, Walker, Hopkins & Hutchinson who have constituted a commission on traumatic hernia for the surgical section of the American Railway Association conclude: "that hernia is never the result of a single trauma but that it must be cumulative over a long period of time."

John W. Morehead writing on traumatic inguinal hernia says: "The type of violence and the place
of its receipt are also important. The essential element in the relationship of violence is did it cause intra-abdominal pressure?" "If so it may be a factor if of a grade sufficient to cause widening of a ring or the canal, if so immediate symptoms would appear and these would be pain, nausea, tenderness and later a mass, and probably some discoloration. If there is no immediate onset, then the relationship is as doubtful as an alleged case of concussion from a blow on the head, in which there was no immediate unconsciousness. The point is that we can not traumatize a piece of intestine or omentum without appropriate manifestations. Try it in operating on a patient under local anesthesia and note what happens. It is absurd to believe that a piece of omentum can be crowded into a normal ring or canal without the patient's knowing about it until hours, days, or weeks later. Yet that is the history we get in the majority of cases."

Morehead goes on to say: "We have fractures of the pelvis, of the thighs and all sorts of injuries in the inguinal region, yet whoever saw or recorded a case in which hernia was an accompaniment."

Charles A. Lauffer says: "In acquired inguinal hernia there is gradual dilatation and nothing is torn. A true traumatic hernia tears the peritoneum
and drives the contents of the sac through the walls of the sac, causes extravasation of blood, produces shock, is immediately disabling and requires surgical intervention. Four cases of traumatic hernia were discovered in a series of 50,000 cases and in one of the four cases the patient was gored by a (19) bull.

Crane states: "A commission of the New York compensation board has hazarded the opinion that traumatic hernia occurred in possibly one out of 10,000 cases." He continues: "If this is the correct proportion and probably that guess is as good as any, the five compensation courts of the state of Connecticut have since the beginning of the act in 1914 awarded damages for more cases of traumatic hernia, than have occurred throughout the world in all time since the creation of man."

La Roque says: "Finally hernia has not resulted experimentally even after leaving a hole in the abdominal wall, down to but not through the peritoneum. Large areas of the abdominal wall involved by dermoids and other tumors, are boldly excised, leaving only the skin and peritoneum at the site of excision."

F. E. Hammond disagrees with the statement of
Morehead quoted above and says: "The finger in the inguinal canal gives little discomfort and as the bowel and omentum are freely moveable in the abdominal cavity, their passage into the canal can not in itself give rise to pain or other symptoms." (10)

In this statement I believe Dr. Hammond has evaded the issue. The pull on the omentum or mesenteries of the intestines is not the only possible cause for pain, but the crowding of the intestine into the comparatively small inguinal canal produces tension on the intestinal walls to which they are extremely sensitive, and which produces a reflex nausea.

Benerjeou expresses his belief in the persistence of the vaginal process as the cause of inguinal hernia and states that trauma is only a reason for discovery of a long existing hernia. (24)

Leigh F. Watson says: "A true traumatic hernia presents a very different picture than the one presented in the so-called traumatic hernia of to-day. In the first place a traumatic hernia is practically never found at the inguinal or femoral opening, but at a point on the abdomen or chest where the blow had been inflicted, usually by something sharp or pointed, such as a wagon pole, iron bar, picket or
bulls horn. The man falls in agony and cannot rise. His face is pallid, anxious and drawn with extreme pain, or else he is unconscious. The pulse is feeble and thready, the temperature is subnormal and there are all the symptoms of profound shock and collapse."

There is often ruptured abdominal viscera and sometimes broken bones. If the injury has not torn a gap in the abdominal wall, there will be evidence of subcutaneous bleeding and laceration of tissues. The hernia is usually small, very painful, irreducible except by taxis and it has no sac. If the patient can live until the physician reaches him, and the treatment can be administered without moving him too great a distance, he may possibly recover.

Coley, among about 2,500 cases of hernia, reports five which he calls "traumatic". Four were caused by kicks in the groin. The other fell against the corner of a car seat. You will note that all were direct violence. In a case reported by Dr. Davis of Washington, D. C., the man fell on a fence railing and tore a hole in all abdominal coverings except the skin. Operation proved it a true hernia.

A case reported by Dr. F. Tilden Brown before the New York Surgical Society, November 11, 1903, is interesting. A horse fell backward upon the man, who
immediately felt pain in left groin and could not stand upright. Examination showed a small hernial protrusion which was reduced by taxis. Ecchymosis followed. Operation thirteen days after revealed a small sac with a bit of omentum the size of a quill adherent to its internal surface. The external ring was very small. (2)

From this discussion it may be seen that traumatic hernia do exist even though they are extremely rare. It is apparent that the so-called traumatic inguinal hernias that make up the bulk of our medico-legal cases are not true traumatic hernias. The question of traumatic hernia simmers down to the consideration of a definition of the condition and establishment of criteria upon which the diagnosis of traumatic hernia may be made. The symptoms of the condition have been adequately explained above. Coley lists six criteria for true traumatic hernia. They are:

(1) Immediate descent of the hernia following the alleged cause, be it injury or strain.
(2) Severe pain in the hernial region
(3) Marked prostration.
(4) Symptoms of such severity that the
individual calls attention to his condition immediately.

(5) No previously existing hernia at the present sight.

(6) Trauma or strain must be adequate.

It would seem to me that to have a real traumatic hernia we should have one of two things: (1) Direct violence at the point of hernia causing such severe injury to the abdominal wall as to produce hernia at once or in a few days. (2) Indirect violence causing enormous increase in intra-abdominal pressure, far out of all proportion to the lifting, straining, etc., of ordinary labor.

The fact that a hernia is first seen after an accident or a heavy lift does not prove that the accident caused the hernia. It in all probability either "discovered it to the patient (if honest) or, worse (if dishonest) furnished him with an opportunity to do a clever bit of malingering and sell and old hernia to his employer. In all hernias following accidents where the violence is not sufficient to cause a hernia in the average man with normal rings, stories by the patient of a sudden appearance of hernia should always be taken with a grain of salt and the burden of proof should be
(2) with him.

There is a group of hernias known as sudden (2) hernias or hernias of effort which are intermediate between the traumatic and ordinary variety. They occur suddenly in individuals, in whom there is a completely or almost completely dilated sac, which may be either congenital or acquired. Since there is sufficient dilatation of the sac to admit a knuckle of gut at such a time when there is sufficient strain as in heavy lifting, slipping, falling, (4) or even on coughing or sneezing. At the instant when they occur there is sufficient stretching of the sensitive peritoneum, pulling on the mesentery, and pressure of the full sac to cause pain, tenderness and nausea. These symptoms make the case an accident and a borderline case. They may become strangulated and require immediate operation.

It may be seen that the true etiological factor in these cases is on a congenital basis, yet it is difficult to say whether or not they should receive compensation.
Predisposing Factors

in the

Etiology of Inguinal Hernia

By predisposing factors is meant those factors which have no direct cause but have an influence on the direct causes. In the predisposing factors in causation of inguinal hernia we must consider; heredity, age, disease, occupation, and physique and posture.

The part that heredity plays in inguinal hernia can hardly be definitely ascertained. That it does have some influence is made certain by the frequency with which a case of inguinal gives a family history of the condition. Bigg on his article on "Hernia Families" describes this condition. It is his idea that the weakness of the inguinal canal and internal ring as well as the tendency to persistence of the funicular process is hereditary.

Charles Mayo Jr. in a paper on inguinal hernia tells of a case reported by Morrison of a woman thirty-eight years old, who came to him complaining of inguinal hernia. Including herself, her parents had had eight children, in five of whom inguinal hernia had developed at various ages. Of the patients children, one girl and three boys, two had
indirect inguinal hernia. One of the patients sisters, who had a hernia, married a man who had a hernia and four children by the marriage all had hernia. (24)

Mayo in his paper reports three brothers who had come to him at different times all with indirect inguinal hernia. In two the condition was bilatera. (24)

If more attention was paid to the family history in inguinal hernia cases there would no doubt be more cases showing the hereditary factor reported. There is at the present time sufficient evidence to establish it as a factor. Moorhead says, "It points to some transmitted strain of muscular deficiency, as typical as a facial feature or a birth mark." He goes on to say, "Another noticeable thing is that as the defect reaches the third generation, the age of occurrence becomes younger." (25)

Hernia may appear for the first time at any age, but the greatest number of hernia are developing during the most active period of life. The frequency with which it appears at different periods of life is very interesting.

A chart from Bergers paper read in the French College of Surgeons in 1819 gives the analysis of
ten thousand cases. The chart shows the cases of inguinal hernias occurring in males by periods of five years. The chart begins high and shows the hernias due almost entirely to unclosed funicular processes, increasing rapidly to five years of age, where it is about seventy-five per thousand. Following this peak there is a rapid fall right through the most active period of childhood, five to fifteen years, although during this age the child does those things usually regarded as the exciting causes of hernia. The curve falls for the same reason the measles curve falls, those susceptible have had them. The fall continues to the age of thirty where it shows only seven per one thousand, the lowest point. Here we have a beginning rise from the development of the acquired forms and possibly the influence of occupation.

(3)
Berger's Chart
The hazards of occupation as a direct cause of hernia have been discussed and ruled out above and the fact that they are only a factor in the extremely rare cases of traumatic hernia established. The point under consideration now is the affect of occupation on the parts that take part in the mechanism.

Much has been said by Hopkins of Chicago and others about the great frequency of hernia among the laborers of southern Europe—Italy, Turkey, and the Balkan States. It is the laborer who continues his work and at the age of forty-five or fifty becomes prematurely old and who can not start the strain of hard work whose abdominal walls will no longer play their part in the resistance of hernia so well as before.

Colcord says: "It seems to me that occupation acts as a cause, not so much in increasing intra-abdominal pressure (the compensatory increase in the abdominal wall will take care of that) but hard labor plus excesses in drink, plus poor food, plus bad hygienic homes and consequent weakening of the abdominal walls. This with heredity and such diseases as tuberculosis and syphilis brings on a condition, which I have called presenility."
It has been postulated that hernias do not occur in quadruped and that the upright position of man is a predisposing factor in hernia development. Woolsey combats this theory by saying; "The suggestion of posture as a factor in the cause of hernia in man is not well founded since it is most commonly found in infancy."

In consideration of the possibility of surgical procedures on the abdominal wall as a possible factor in causing inguinal hernia: Griffiths has reported a series of one hundred cases of appendectomy by the trid-iron incision, following which eleven of the men developed right indirect inguinal hernias. The hernias were all small (these men were all members of the British Navy). The hernia sacs varied in thickness, but were mostly thin suggesting recent origin. In two of the hernias the sac was thought to be of the congenital variety leaving nine which were evidently acquired. Griffiths offers the explanation, that either by avulsion or division of the fine muscular nerve twigs to the lower portion of the internal oblique and transversalis muscles, during the operation, lead to a complete or partial atrophy of the muscle fibers in the region of the in-
ternal abdominal ring, or on the other hand by compression of the same nerves by encircling cat gut sutures.
Presentation of Six Cases of Indirect Inguinal Hernia

In the report of these cases I have endeavored to bring out only those points which are essential from the standpoint of the hernia problem. In each case the physical examination was essentially negative except for the hernia findings. I have in each case tried to make clear any points leading up to or directly responsible for production of the hernia. The family history of each case was gone into thoroughly in an endeavor to establish any hereditary factor.

These cases were all seen personally.

Case I. Hospital No. 38286: Mr. P, white, male, age 72 years, married, farmer; was admitted to the University Hospital March 17, 1933 complaining of a swelling in the right groin which was painful at times for past six months.

Onset and Development: Seven months ago he was at the University Hospital for the repair of a ventral hernia. Immediately after returning home subsequent to that operation he noticed a small bulging in the right groin, which has since continued to enlarge.
The hernia mass never reached the scrotum, had very little associated pain and was always reducible. He is certain that the condition was not present before the repair of the ventral hernia and that there was no unusual strain that might have caused the hernia.

The examination revealed a mass in the right inguinal region the size of a hen's egg on straining. The mass did not protrude past the external ring and was easily reducible. The external ring was relaxed and the inguinal canal patulous and easily examined. The internal ring was approximately one inch in diameter and the walls relaxed.

There was no history of any other hernia in the family.

He was operated March 26, 1932. A larger amount of sub peritoneal fat was pedunculated into the sac. The surgeon believed this to be an etiological factor.

This case presents the possibility that there was enough injury to the nerves supplying the lower abdomen, during the repair of the ventral hernia to cause enough relaxation of the internal ring to allow protrusion of the fat into a preformed sac.

Case II. Hospital No. 38465: Mr. B, white, male, age 71 years, married, farmer; was admitted to the
University Hospital March 31, 1932 complaining of left inguinal hernia that descended into the scrotum.

Onset and Development: Thirty years ago while walking beside a wagon loaded with corn he grabbed the wheel of the wagon with his right hand and held it so that it skidded for twenty feet. When he released the wheel he said it felt like something gave way in his left side. He noticed no bad results of the incident till ten years later while he was plowing, when he noticed a burning sensation in his left groin. He consulted a doctor, who told him he had a hernia and he started wearing a truss. He began noticing some dulling in the left inguinal region a few weeks later. The hernia has kept increasing in size for the past twenty years. It has at times been difficult to reduce.

Physical examination showed brownish discoloration of the skin over its hernial area. Both rings were markedly relaxed and a mass that descended into the scrotum could be seen and palpated. There was no family history of hernia.

Diagnosis—Left indirect inguinal hernia. Operated April 6, 1932.

Case III. Hospital No. 38490: Mr. F., white, male,
age 63 years, married, truck gardener; entered the University Hospital April 2, 1932 complaining of a mass in the right groin and pain in that region when lifting.

Onset and Development: One year ago while working in his garden he noticed a peculiar tingling sensation in his right inguinal region. Within a few days he noticed a mass in that region that could be easily reduced. The mass gradually increased in size and at times would almost to into the scrotum. It was very painful when he lifted. He has worn an abdominal support for the past eight months.

Physical examination:— On standing and straining a hernial mass passes through the left inguinal canal into the scrotum. Both rings on the left side are relaxed and two fingers enters the canal easily. On the right side the external ring is so relaxed that it is hardly discernable and the internal ring is approximately one inch in diameter. A definite impulse and some bulging is felt on coughing.

Family History: His father and one brother both had inguinal hernias.

Diagnosis— Bilateral indirect inguinal hernia.

Operated March 8, 1932. The surgeon's diagnosis was that the sac was of the acquired type, it was very
thin and adherent to the cord by only a few fibers. A definite thickening of the peritoneum could be felt at the medial side of the internal ring. Both sides were repaired.

Case IV. Hospital No. 38361: Mr. B., white, male, age 33 years, married, barber; entered the University Hospital March 34, 1932, complaining of a left inguinal hernia.

Onset and Development: Five years ago while lifting railroad ties, a small lump the size of a robin's egg appeared in the left inguinal region. No pains accompanied the onset. The hernia has not increased in size but has been painful on lifting.

Physical examination shows a mass the size of a quarter in the left inguinal canal. The left external ring is relaxed enough to admit the middle finger and the canal is easily examined. The internal ring on the left side is about one inch in diameter. An impulse is felt at the internal ring on the right side.

Family history: The patient's mother had an inguinal hernia.

Diagnosis: Left indirect inguinal hernia. Patutial indirect inguinal hernia on right side.

Operated: March 29, 1933
Case V. Hospital No. 38443: Mr. L., white, male, age 68 years, married, laborer; entered the University Hospital March 30, 1932, complaining of a mass in the right inguinal region, painful at times and a similar but much smaller mass in the left inguinal region.

Onset and Development: The mass in the right side has been present since he was one and one-half years of age. The hernia bothered him some while he was going to school and he wore a truss for eighteen months while he was around twelve years of age. There never has been a time when the hernia could not be reduced. It has been quite painful on lifting for several years. When he was examined for the army he was told that he had a hernia on the left side too. He has noticed some bulging on the left side for the past two years but it has never caused him any trouble.

Physical examination: A mass the size of a hen's egg bulges from the external ring on the right side. It is easily reducible. Both internal and external ring on the right side are markedly relaxed. The external ring on the left side admits two fingers easily. The canal walls are relaxed and the internal ring is somewhat enlarged. An impulse is felt on straining, at the internal ring. No visible bulging on the left side.
There is no family history of hernia.

Diagnosis: Bilateral indirect inguinal hernia. Operated April 2, 1932: A congenital sac was found on the right side extending clear to the testicle. The internal inguinal ring was one and one-half inches in diameter and there was an unusual amount of sub peritoneal fat.

Case VI. Hospital No. 38324: R. Z., white, male, infant, age 2 years, entered the University Hospital March 26, 1932.

Onset and Development: The story given by his parents was that he fell down seven steps in August 1931, and following this a mass was noticed in his right inguinal region. The mass increased in size and descended into the scrotum. A truss was applied but was discontinued after an inguinal abscess formed.

Physical examination: There is a bulging in the right inguinal region and an enlargement of the right scrotum. The mass is reducible. Both rings on the right side admit the middle finger. On the left side the external ring is relaxed and the definite impulse can be felt at the internal ring.

There is no family history of hernia.

Diagnosis: Right indirect, inguinal hernia. Operated March 31, 1932; Right hemorrhaphy.
In this case due to the early onset and the immediate development, it may be said that a congenital preformed sac was present and the fall created the strain necessary to force the viscera into the sac. The patient will no doubt develop a hernia on the left side later in life.
Conclusion

The etiology of inguinal hernia both direct and indirect is entirely on a congenital basis. Direct inguinal hernias occur due to a congenital weakness and relaxation of the external inguinal ring some congenital abnormality of the conjoined tendon. The strain or unusual effort that is generally given as the cause of the hernia is merely the factor that draws the hernia to the attention of the individual. There is no possible means of increasing the intra-abdominal pressure to such an extent that a protrusion of the peritoneum can be produced at this point without some abnormality of the conjoined tendon.

In contra distinction to the indirect variety, there is never a congenital preformed sac in the direct variety. The congenital factor involves only the abdominal wall, and the sac is formed by gradual dilation of the peritoneum at that point by a series of strains causing increase in intra-abdominal pressure.

The indirect inguinal hernia is either congenital or congenitally acquired, that is there is either a congenital sac due to failure of agglutination of the processus vaginalis or the fascia, tendons and muscles that make up the internal ring, inguinal canal.
and external ring are congenitally so weak or deficient that the valve like action of the normal inguinal canal is not present, and the gradual pouching of the peritoneum through the internal ring is allowed. It must be understood that this pouching in the formation of an acquired sac is a gradual process and not the result of one strain.

True traumatic hernia do occur but extremely rare and only a very small percentage of those that do occur are inguinal. Any hernia that measures up to the specifications listed in the section on traumatic hernia are compensable. A hernia of this type that occurs during the course of a man's duties is directly due to the act which causes it and is always compensable.

Inguinal hernias that are not of the traumatic should not be compensable. When a company is held responsible for such a hernia they are being unjustly charged for a congenital defect which their employee happens to possess. The fact that the incident which brought the employee's attention to his hernias occurred during his line of duty has no bearing on the compensability. Any strain that occurs in everyday life, such as coughing, sneezing, straining at stool, etc., is sufficient to cause pro-
trusion of a hernia, if the congenital defect is present. The fact that the individual does have a congenital defect is a hazard, which he must accept as inevitable in his case and proceed in life at his own risk.

The old term "rupture" and the rulings of the English courts during the eighteenth and nineteenth centuries is no doubt responsible for the fact that in most states today inguinal hernia is still compensable. For many years the etiology of inguinal hernia as I have given it has been accepted by authorities on the subject and volumes of literature have been written on it. Not withstanding this a large majority of practicing physicians are either not acquainted with this phase of the subject or are not confining their opinions rigidly enough to facts proven in the literature and as a result the law profession is dealing with a profession that is divided in their opinion. Until the medical profession as a whole accepts and rigidly carries out the congenital theory of eteology of inguinal hernia, the unjust compensability of it will continue to exist.

Since inguinal hernias and potential inguinal hernias are so common a great many men would be unemployed if industry should refuse to hire such men.
An industry should feel safe in employing these individuals providing they give their employees physical examinations on entrance and subsequent routine examinations and accurate records are kept of the same. A definite classification of hernia should be adopted by the firm. This classification should be one, which embodies every degree of hernia from the mere relaxation of an inguinal ring to the indirect type that descends into the scrotum. The man on entrance into the firm should be told the degree of hernia he had, if any, and the potentialities of such a condition should be explained to him. On subsequent examinations if any change in the hernia has taken place this fact should be recorded and also explained to the man.

In order for a firm to protect itself it is necessary for them to employ a competent man as their medical examiner. This man, as far as his knowledge of hernia, should be well acquainted with the importance of his findings in examination of the inguinal region and should be well versed in the methods of examining the inguinal region and aware of the difficulties that sometimes exists in determining whether a hernia or potential hernia exists.
Bibliography

1. Bigg, H. Hernia Families

2. Colcord, A. W. Hernia—Should It Be Classed As A Compensable Injury Or A Disease?
   Pennsylvania Medical Journal, 1918, XXI, 672-684.

3. Colcord, A. W. A Report Of 30,000 Physical Examination With Special Reference To Open Hernial Rings And Hernia.


5. Coley, W.B. Industrial Hernia.

   Progressive Medicine, 1924, II, 71-80.

   Legal Medicine And Toxicology, 1923, 330-381.


   Lancet, 1919, II, 1026.


28. Parker, Owen W. Indirect Inguinal Hernia And Its Relation to Accidents And Workmen's Compensation.  
Minnesota Medicine, 1925, VIII, 719-726.

29. Russell R. H. The Radical Cure of Inguinal Hernia in Children, With Special Reference to the Embryonic Rests Found Associated With the Sacs.  
British Jour. of Surg., 1921, IX, 445-448.

British Jour. of Surg., 1921, IX, 502-528.

The Medical Journal and Record, 1930, CXXXI, 93-94.

32. Shafer, F. Wm. The Relation of Trauma to the Etiology of Inguinal Hernia.  
The Journal of the Medical Society of New Jersey, 1930, XXVII, 111-114.

33. Swackhamer C. R. Industrial Hernia.  
Southwest Medicine, 1925, IX, 304-306.

34. Watson L. F. Compensation in Industrial Hernia.  
The Clinic, 1928, VI, 3-4.


