P I L O N I D A L   S I N U S

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Though a relatively small segment of the vast
realm of general surgery, pilonidal sinus is of partic-
ular importance and interest to the surgeon because of
the confusion which still exists as to its origin, the
degree of discomfort and disability it occasions until
dealt with surgically, and the singular difficulties en-
countered in its effective management.

The term "pilonidal sinus" was coined by R. M.
Hodges [1] in 1880 to describe a lesion overlying the
sacro-coccygeal region presenting as a sinus and con-
taining hair (Latin: pilus, hair; nidus, nest). It has
been applied in many subsequent articles to lesions simi-
lar with the exception that no hair is present, and even
to cysts in this region with or without the association
of a sinus, and whether or not hair is present in the le-
sion. Though frequently attacked as a misnomer because
at least half the characteristic lesions do not contain
hair, it has remained in general usage in America, being
used interchangeably or in conjunction with the term "pilo-
nidal cyst". In the recent literature "pilonidal disease"
is used more and more frequently to include both cysts and
sinuses and their complications, and is obviously prefer-
able, but "pilonidal sinus" is still the most popular,

perhaps because of its alliterative quality.

The matter of terminology has confused the issue since the earliest recognition of these lesions, and "coccygeal fistula" is the term most commonly used in Europe. Others encountered in the literature are: sacral, sacrococcygeal or coccygeal dermoid, dermoid fistula, infundibulum, sinus, or cyst; posterior umbilicus; post-anal dermoid; congenital dermal sinus; sacrococcygeal ectodermal sinus; sacrococcygeal cyst teratoma.

HISTORY

This year might be called the centenary of pilonidal sinus in medical writing, for in 1847 A. W. Anderson [2] published a case report entitled "Hair Extracted from an Ulcer" and thus introduced the subject to the literature. His patient was a "young man, aged 21 years, (who) said he had a scrofulous sore on his back which he believed would use him up". From the description given in his report this was undoubtedly an infected pilonidal sinus.

In 1854 J. M. Warren [3] reported three cases of abscesses in the sacro-coccygeal region containing hair, and again in 1867 stated he had seen 8 - 10 cases, one in a woman who was hairy and the others in hairy men. He is credited by most writers with giving the first detailed description of a pilonidal sinus.

Vaughan [4] reported three cases of "pilous cysts" in 1865.

In 1880 Hodges reviewed the literature, added one case of his own, and coined the term "pilonidal". Also in 1880 Mason [5] reported a case in a woman.

With the focussing of attention on these lesions many theories were advanced to account for them, and from this time until the turn of the century numerous articles were published which were concerned with this phase of the subject. Also in more recent years several detailed studies have been carried out and reported.

The problems concerned in treatment of the lesions have however gradually usurped the field, and increasing numbers of articles have appeared in the last three decades dealing with this aspect. The recent war has been an important contributing factor because of the age group involved together with the increased opportunity for trauma to the sacrococcygeal region as well as to others. The problem has assumed large proportions in the armed forces especially in America, and numerous published reports indicate considerable controversy among the proponents of various treatment methods.

EMBRYOLOGY

It is universally agreed by all who have made a study of the subject that pilonidal sinuses and cysts are congenital in origin, and we must therefore turn to a consideration of the development of the caudal end of the

human embryo in searching for a cause.

The primitive streak which appears about the third or fourth day in the long axis of the embryonal area is on cross-section a thickening of the ectoderm and contains a median furrow, the primitive groove, terminating cephalically in a node (Hensen's node) in the center of which is found a depression, the primitive pit. At this point there is a close association and transition between the ectodermal and entodermal layers. At about the fourteenth day the medullary plate, made up of ectodermal cells, is laid down in the mesial portion along the long axis. These cells curl laterally to form the medullary groove [6]. At the same time a cord of cells of mesodermal origin grows cephalad from the primitive node beneath the medullary groove, and forms the notochord, the forerunner of the vertebral column.

Quain [7] states: "In the formation of the medullary canal the epiblast thickens to form the medullary plates, which bending round dorsally, meet in the middle line above the medullary groove and there coalesce, at first in a limited space near the middle, and later both forward and backward, so as to effect the union along the whole dorsal line, except at the hinder incomplete part. By this union the medullary plates and groove are converted into the neural or medullary tube, which constitutes the primary form of the brain and spinal marrow. The spinal portion (of the medullary canal) retains a more uniform, cylindrical shape,

excepting toward the caudal extremity, where it is longer in being formed and remains for a time a flat, open, rhomboidal dilatation. The spinal cord has been found by Kölliker already in the form of a cylinder in the cervical region of a human embryo of four weeks. Ununited borders have been seen by Tiedemann in the ninth week toward the lower end of the cord, the perfect closing of the furrow being delayed in that part, which is slightly enlarged and presents a longitudinal median slit analogous to the rhomboidal sinus in birds". The last points of the neural groove to close at the cephalic and caudal ends are known as the anterior and posterior neuropores, respectively.

The final closure of the posterior neuropore results in placing the primitive pit in the floor of the caudal extremity of the primordium of the spinal cord. A rupture of the floor of this pit establishes a communication between the underlying gut and the lumen of the neural tube around the end of the notochord, which is early and transitory and is known as the neurenteric canal [8].

Until the beginning of the third month the cord extends the whole length of the embryo, into the developing coccygeal region. However, in later stages the cartilages and bones of the vertebral column, which have developed in the mesoderm surrounding the cord, grow more rapidly than the cord itself, so that by full term the original coccygeal end of the cord lies at the level of the third lumbar vertebra. Below this level it is represented by the filum

terminale, which is enclosed within the subarachnoid space as far as the middle sacral region, and is attached to the posterior surface of the coccyx [9].

ETIOLOGY

The origin of pilonidal lesions is of uncommon interest as a theoretical study, but also has a practical application in the designing of surgical procedures for their eradication.

To the earliest writers on the subject the presence of hair in the sinuses excited most curiosity and interest, as indicated by the titles of their reports: "Hair Extracted from an Ulcer", "Three Cases of Pilous Cysts", "Monstrosity by Inclusion", "Abscess of the Sacrum; Hair", and others.

Warren was the first to advance a theory as to etiology - "It would seem possible that it may begin in the stout hair or hairs from a single follicle becoming in some way diverted from their normal direction and inverted upon themselves within the follicle itself". Vaughan's theory was essentially the same.

Gross [10] described it as "a small congenital pilocystic tumor arising from a sebaceous follicle which during development intercepts a small tuft of hair", and thus was the first to assume a congenital origin.

Hodges considered three factors necessary - a

congenital coccygeal dimple, abundant hair development, and uncleanliness of the individual - the hairs growing into the dimple and causing inflammation. Essentially the same theory had been put forward several years previously by Lamadrid (1873) [11].

Walker (1875) [12] spoke of a "monstrosity by inclusion", and Féré (1878) [13] considered the defect was due to incomplete closure of the "posterior umbilicus" (posterior neuropore). Heurtaux (1882) [14] considered that accumulation of sebaceous and epidermal products took place in "congenital infundibula" and caused inflammation and suppuration.

Terrillon (1882) [15] thought a special form of spina bifida involving not the vertebral arches but simply the skin, was the cause; Kuhn [16] considered the lesions remaining traces of spina bifida; and Lawson Tait (1892) [17] spoke of "the hereditary cicatrix of the spina bifida by which the human tail is lost".

Lannelongue (1889) [18] stated: "the mesoblast lies, after formation of the medullary canal, between the external dermis and the vertebral column, except in the region of the sacrum, where little of this tissue is interposed, so that this region is reduced to epidermis and bone. Consequently the superficial layer, the epiblast, joined at a later period to the mesoblast, preserves closer relation with the bone, and later, when the subcutaneous tissue is developed around these places a depression

will be formed. If deep and narrow enough, the orifice may close up and a dermoid cyst will be the consequence".

Couraud [19] in 1883 quoted all the theories to date and considered that post-anal dimples, sinuses and post-sacral dermoids were all different degrees of the same defect. This and Lannelongue's theory were closely approximated by Wendelstadt [20] in 1885: the inferior end of the spinal cord is the last portion to lose connection with the skin, and as the sacrum closes together and pinches off this connection, the skin becomes attached by a fibrous cord at this point to the posterior surface of the sacrum. As adult life approaches fat and soft parts grow and lift the skin farther away from the bone, the attached area being thus drawn down into a dimple or sinus, and perhaps being closed over to form a cyst.

Masse (1885) [21] mentioned the neurenteric canal as a possible origin along with the medullary canal, and Bland-Sutton (1886) [22] blamed slight defects in the co-alescence of the superficial portions of the medullary folds in the sacro-coccygeal region. This is almost exactly the same as the theory put forward by Aschoff [23].

Tourneux and Hermann [24] in 1887 made the first exhaustive study in this connection, by making serial sections of human and chick embryos, concluding that in the young embryo the spinal cord first extends to the tip of the vertebral column and becomes attached to the skin

caudally. At the end of the third month considerable inequality in growth results in drawing the spinal cord upward in a cephalad direction. The stretched distal portion, though still adherent to skin, and continuous in structure with the rest of the spinal cord, becomes divided into two segments, a "direct" part and a caudal or "reflected" part. By the fifth month the proximal or direct portion has atrophied and disappeared, and the reflected portion becomes separated from the central nervous system. This vestige becomes converted into a tubular structure lined with columnar or polyhedral epithelial cells to which they give the name "coccygeal vestiges of the medullary tube". This structure reaches its maximum development in the fifth month and subsequently undergoes progressive degeneration and atrophy. They believe that failure of this structure to atrophy is the etiological factor in the formation of congenital sacrococcygeal tumors and sinuses.

Mallory [25] in 1892 made an almost exactly similar study independently in America, sectioning six foetuses 3 to 6 months old, and drew the same conclusions.

Stolper [26] in 1899 thought Mallory and others went "far beyond the indications" in ascribing to the medullary vestiges these sacrococcygeal defects. He thought the connective tissue strands accompanying the coccygeal medullary vestiges kept on growing and created the dimples and sinuses by pulling on the skin, the rapid foetal de-

velopment of skin doing the rest.

Stone [27] made a very careful study of embryos in 1924, and noted the coccygeal medullary vestiges of Tourneux and Hermann but considered they had no etiological significance as the single layer of columnar cells lining them had already become so differentiated that they could not be expected to later give rise to skin. He worked with Streeter [28], whose opinions are the same as his own in this regard. They found fairly constantly a deep invagination of the skin in the sacrococcygeal region, which tended to disappear in older foetuses, and considered that these persisted sometimes to form sinuses and cysts in extra-uterine life.

They could give no reason at the time for invaginations in this region, but Stone published an excellent paper [29] in 1931 drawing an analogy with the uropygial or "preen" gland found in birds. Almost all birds have this gland, and also all amniotes - reptiles, avians and mammals - present species that have similar or analogous structures. These glands are nearly always located about the anal or caudal region, close to the skin which covers them, and from which they bud by invaginations of epithelium. They are in or near the posterior midline, and have one duct or several up to six, with usually a tuft of fine hair-like feathers called the "wick" about the orifice of the duct. The direction of the duct or ducts is cephalad, similar to the direction of the pilonidal sinus in humans. These

glands produce oil for the feathers but are also scent
glands concerned in protection and sexual attraction, and
Stone suggests the possible connection between this fact
and the development of symptoms of pilonidal disease shor-
tly after puberty in the human.

Bookman [30] (1924) thought the lesions were due
to the displacement of "dermal or dermoid" cells in the
embryo which are lost during the process of fusion in the
midline and then assume an abnormal location under the
skin, the products of skin metabolism accumulating and
forming a cyst.

Oehlecker [31] in 1926 elaborated his "sacral bald
spot" theory, stating that a connective tissue prolongation
of the caudal vertebrae, of mesodermal origin, remains at-
tached to the skin, radiating into it at a very thin, hair-
less, vascular area which he calls the sacral bald spot of
the embryo. The radiations of the caudal filament or liga-
ment exert a certain pull on the overlying skin as the ver-
tebral column grows more rapidly than the skin, and a de-
pression or fistula is formed, the margins of the surroun-
ding skin containing hair follicles also being to some deg-
ree invaginated.

Weinstein (1933) [32] states: "the most plausible
modern theory regards pilonidal sinus as a special local
downgrowth of epithelium originating from true skin, and
not the medullary groove".

Newell (1933) [33] considers the cause to be traction

of the underlying tissue on the median raphe, resulting in a traction dermoid.

Fox [34] in 1935 published a very careful study of serial sections in seven human embryos 14½ to 29½ weeks of age and found the coccygeal medullary vestiges tending to be replaced by fibrous tissue and blood vessels in older embryos, but very definite ectodermal invaginations as described by Stone. He concludes that pilonidal sinus and cyst are caused by persistence of normal ectodermal invaginations occurring in the embryo, and that the coccygeal medullary vestiges cause such rare tumors as neuroblastoma, neuro-epithelioma, etc.

Gage (1935) [35] reviewed the literature and examined an 11 cm. embryo, confirming the presence of the coccygeal medullary vestiges and concluding that pilonidal sinus arises from the neural canal.

Kooistra [36] in a very careful study by serial section of 40 human embryos published in 1942 concluded that the lesions were congenital, and originating either in ectodermal invaginations or from the neural canal, but thought the evidence not conclusive enough to state which. He inclined to the belief that pilonidal sinuses originate by ectodermal invagination, and that pilonidal cysts originate from the neural canal (coccygeal medullary vestiges), and that both might coexist or communicate secondarily as a result of infection or trauma.

Recently Kallet [37] has stated his belief that the pilonidal sinus represents a growth derived from an embry-

onic remnant of a vestigial sex gland located in the sacro-
coccygeal region.

Mummery (38) "believed that the sinus is only an ex-
aggeration of the post-anal dimple, and that it is a seque-
stration dermoid due to inclusion of skin".

In all some twenty-five different theories have been
brought forward, as here outlined. It is obvious at once
that we are very little nearer a definite knowledge of the
true origin of these lesions at the present time, than when
they were first described a century ago. The best we can
do is to narrow the field down to four main theories:

1. The "neural canal" theory of Fère, Terrillon,
Bland-Sutton, Tourneux and Hermann, Mallory, Gage and others,
which postulates some abnormality of development of the cau-
dal end of the medullary canal.

2. The "ectodermal invagination" theory of Stone,
Streeter, Weinstein, Fox and others, with its associated
"preen gland" and "sex gland" theories of Stone and Kallet.

3. The inclusion dermoid theory of Lannelongue,
Wendelstadt, Oehlecker, Aschoff, Mummery and others.

4. The "combined" theory of Kooistra, supported
by Granet and Ferguson (39).
The second theory would appear to be the most popular at the
present time and is perhaps the most attractive, but many
surgeons adhere to the others.

The "neural canal" theory is the only one subject to
corroboration clinically, and an occasional case has been

reported which seems to offer some support. Thus Ripley and Thompson [40] report a case of staphylococcus meningitis in a $3\frac{1}{2}$-month infant in which pus was noticed at the bottom of a sacrococcygeal dimple into which a probe could be passed in a cephalad direction for 5 cm. At operation the probe was cut down upon and a sacculation full of pus was found in connection with a spina bifida. Thick pus was also recovered at spinal puncture and antimeningococcic serum injected appeared at the operative wound. At autopsy methylene blue injected into spinal needles in the 3rd. and 4th. intervertebral spaces appeared at the operative wound and also was recovered by cisternal puncture. A complete autopsy was not done.

Moise [41] reports the case of an 18-year old male who had a small sinus in the posterior midline at the level of the first sacral segment, which had at intervals discharged a clear fluid presumably spinal fluid. Inflammation in the sinus area was associated with the development of staphylococcus meningitis and at operation the sinus was found to communicate directly with the spinal canal. There was an associated spina bifida below the level of first sacral.

Kooistra states that fourteen cases have been reported in the literature where communication of a pilonidal lesion with the spinal canal occurred, and reports one of his own in which the sinus was at the level of the 3rd. dorsal vertebra and presented signs and symptoms of a cord

tumor. At operation the lesion was found actually to invade the spinal cord.

Gage records the case of a 30-year old woman whose symptoms recurred following excision and at a subsequent operation the sinus was followed into the sacral canal and a fibrous cord 0.5 cm. in diameter pulled down and severed by scissors. An immediate gush of cerebro-spinal fluid occurred from the severed end. On micro-section the tract was lined by squamous epithelium and at the upper end an area of embryonic nervous tissue was found which proved to be neuroglia.

One who is not convinced by the "neural canal" theory can however quite easily explain the reported findings in each of these cases on a different basis.

Ferguson and Mecray [42] give as arguments against the neural canal theory the general absence of nerve tissue in sections from pilonidal lesions; the universal presence of squamous epithelium as a lining for the cysts and sinuses; and the absence of any dermoid structures other than hair and sebaceous material.

The etiology of recurrence of symptoms following operation is considered under the headings of treatment and results, since this is assumed to be entirely due to defective management in some particular.

Whether heredity constitutes a factor in etiology is difficult to determine from the available data. The majority of writers consider that it is not [43,42], but Kooistra finds 10% in his series of 350 cases in which one

or more relatives had pilonidal lesions. Smiley [44] had a brother and sister in his series, and also one patient whose brother had a similar lesion and one whose father had had an operation for pilonidal sinus. Stone had a father and his two sons among his patients, all of whom had pilonidal disease.

A consideration of etiology must include secondary factors such as trauma and infection, but since these are concerned only with the onset of symptoms in a pre-existing lesion, they will be discussed under the heading of symptomatology.

FREQUENCY AND IMPORTANCE

How many of our forefathers carried on in spite of recurrent pain, swelling and discharge in the sacrococcygeal region can only be imagined, but that pilonidal disease is steadily increasing in importance can hardly be doubted. Bernstein [45] states that 218 original articles on this subject were listed in Cumulative Medical Index to the end of 1945, 80 published in the period 1941 - 1945. 8 more are so listed in the first half of 1946, and at least the same number have appeared since.

Largely because of the sex and age group involved the recent great war has brought the subject to the fore, and it is stated that in the armed forces of the United States in the years 1942 and 1943 pilonidal disease out-

ranked inguinal hernia and venereal disease in sick days lost, and in this respect stood just below appendicitis [46]. 359,209 sick days were lost in the U.S. Navy alone during these two years [47].

Frequency of occurrence is variously reported. Dulligan [48] reported 25 cases in 25,000 admissions at St. Mary's Hospital, Brooklyn, and "about the same number in the same period" at the Greenpoint Hospital in Brooklyn. Kooistra noted 350 cases in 313,285 admissions over a 14 year period at the University Hospital, Ann Arbor, Michigan. Weeks and Young [49] report an incidence of approximately 1:1000. Winkler [50] found 30 in 19,000 hospital admissions, roughly 1:600. Breidenbach and Wilson found 1:1683. Ferguson and Mecray reported an incidence of 0.9% in the Surgical Out-Patient Clinic of the Hospital of the University of Pennsylvania during a six year period but attributed the high incidence to the high percentage of young adults attending the University and their own known interest in the condition. Roughly the frequency is generally considered to be about 1:1000 hospital admissions.

Post-anal dimples and pilonidal sinuses are associated by many clinicians, and it is interesting to note that Lannelongue found dimpling or sinus formation in 20 - 25% of all young children examined, Despres [51] in 30 - 33% at birth, Heurtaux in 4 - 5% of adults, and Lawson Tait in 23% of women examined at the Birmingham Hospital. Markoe and Schley [52] examined 300 consecutive babies in New York

and found dimpling in 89, sinuses in 11. Ravdin and Johnston [53] report 3.6% of 1,040 men examined at a Citizens' Military Training Camp who had marked post-anal dimples or pilonidal sinuses.

No data are available with regard to a possible increase in absolute frequency, but most clinicians feel that many more are seen now than formerly. This probably is due partly to the fact that a great many have been rendered symptomatic by trauma and infection due to the war either directly or indirectly, who otherwise might have carried on with a pilonidal lesion without knowing it was present. One can remember as a student being shown a case as a rarity and almost as a curiosity, whereas there are now few students who have not seen several in the ordinary course of their clinical studies. In several months spent in examining men being discharged from the Canadian Army I was impressed by the frequency with which this so-called uncommon lesion was seen, in perhaps half the cases giving rise to no symptoms and existing unknown to the subject.

SYMPTOMATOLOGY

The typical patient with pilonidal disease presents himself to the surgeon complaining of soreness and irritation in the sacrococcygeal region and a slight chronic discharge for a varying period, and gives a history of

one or more "boils" or abscesses in the same region which
have ruptured or had to be "lanced". Many will appear at
the time of an acute flare-up, when all the symptoms of an
acute abscess or cellulitis are present. An occasional
patient will complain only of pain or tenderness in the
area, or of a tender lump noticed on sitting down or stoo-
ping over. Some have noticed only a chronic or intermittent
discharge which stains the underclothing and is a source of
annoyance.

A considerable percentage give a history of pre-
vious surgical treatment apart from incision and drainage
of an abscess, and complain of a recurrence of the same
symptoms or of tenderness, pain, numbness, itching, or ir-
ritation of the scar, or of a wound which refuses to heal.

Symptoms not referred to the sacrococcygeal region
are comparatively uncommon, but occasionally a patient will
complain of pain and swelling or a discharging sinus in the
perinaeum or thigh secondary to a pilonidal lesion in the
sacrococcygeal region. Discharging sinuses in the buttock
are quite common.

Rarely there may be a discharging sinus in or near
the midline at a higher level with perhaps intermittent
discharge of watery fluid, and infection in such a sinus
may be associated with signs and symptoms of meningitis,
subdural abscess or cord tumor.

Symptoms are due entirely to infection occurring
in the lesions with the possible exception of a true pilo-

nidal cyst where only a lump may be noticed, or where there is a communication with the subarachnoid space and discharge of spinal fluid, or after surgical treatment when scar tissue may cause symptoms.

The role played by trauma in the onset of symptoms is variously estimated. 14% of Kooistra's patients and 13% of Breidenbach and Wilson's series had had either a fall or a blow resulting in trauma to the sacrococcygeal region within a month of the onset of symptoms. Brock-bank and Floyd [54] report an incidence of 6.7% with a definite history of recent trauma. Most authors consider that trauma occupies a minor role, but surgeons in the armed forces who have reported on pilonidal disease almost invariably consider that trauma is important, either from single fairly severe blows or repeated minor traumata as from riding in or on service vehicles.

Granet and Ferguson consider the characteristic posture of the sailor sitting on the deck with knees drawn up and rocking back and forth with the motion of the ship as a very definite etiological factor. Buie [55] has coined the term "Jeep Disease" which needs no explanation to those who have had the experience of riding in these vehicles for more than short distances. Repeated chafing and irritation in the natal cleft by clothing during active exercise is credited by many with an active role in etio-logy [56].

Trauma is generally considered to be particularly

important in the production of recurrent symptoms follow-
ing excision, before the deeper parts of the wound have
become firmly healed.

CLINICAL MANIFESTATIONS

Though varying within fairly wide limits the clini-
cal manifestations of pilonidal disease are very character-
istic in the vast majority of cases, and after one has been
seen they are usually recognised immediately. Typically
the external opening of a sinus lined with skin is seen in
or near the midline posteriorly, at the level of the sacro-
coccygeal joint or near it. There may be more than one such
sinus - rarely up to four - situated close together. Some-
times a tuft of hair is seen to project from the sinus or
sinuses, and there may be slight discharge of mucoid or muco-
purulent secretion. A probe passed into the mouth of the
sinus will pass upward toward the sacrum for from a fraction
of one to several cm. In the case of a cyst a rounded lump
is felt between skin and the underlying bone, which may be
tender in varying degrees, and often associated with dimpling
of the overlying skin in the neighborhood or associated sinus
formation.

The uncomplicated lesion as described above is how-
ever rarely seen except by chance, the patient usually pre-
senting himself for treatment when infection has occurred.
As the result of infection all degrees of local inflammatory

reaction may be superimposed, with commonly abscess forma-
tion and scarring, and the production of secondary sinuses
and fistulous tracts lined with granulation tissue and scar.
Often the original skin-lined sinus opening can be seen but
there are commonly only granulation-lined sinuses formed as
the result of burrowing of infective processes in the fatty
surrounding tissue. These may open at a distance in buttock,
thigh or perinaeum. Very often one or more scars will in-
dicate previous operative treatment, incision or excision.

Granet and Ferguson state the lesions found are of
three types: cysts alone; dimple or sinus, single or mul-
tiple, alone; cyst adjacent to or communicating with one or
more sinuses. The latter is confusing since a cyst cannot
exist as such if it communicates with the exterior by a sinus
- it must be considered then as part of the sinus or perhaps
as a blind pouch or sacculation at the end of the sinus.
This improper terminology is quite common in the literature
and helps to confound the reader. Kooistra found cysts alone
in 10% of his 350 cases.

The percentage of occurrence in females as compared
with males is fairly constantly 1:4. Ravdin and Johnston
collected 505 cases from the literature of which 407 were
males and 98 females. Kooistra reports 73.7% males in a
series of 350, and Breidenbach and Wilson 83.5% males in 288
cases.

Onset of symptoms occurs in the great majority in
the second and third decades of life, and more commonly be-

tween 18 and 25 years of age. In Kooistra's series the
average age at onset of symptoms was 21.5 years, and the
same was reported by Stone. The former noted a sudden
incident rise at 17 years carried on through 25 years.
Weinstein states the average age of onset in his series
was 25 years, the youngest 17 and the oldest 39. Symp-
toms may however appear at any age. In some cases in
Scott's series symptoms had been present up to 17 years,
an average duration of 21 months being noted. Kooistra
noted that 40% of the females in his group of cases de-
veloped symptoms before the age of 20, whereas this was
true of only 19% of the males. He considers that since
the human female reaches puberty earlier than the male
"it appears that these lesions are stirred on to activity
by the sex hormones".

Pilonidal disease appears to be almost completely
confined to the Caucasian race. No cases have ever been
reported in the yellow, brown or red races [36,42], per-
haps because no systematic study has ever been undertaken.
It is rare in Negroes but 11 have been reported in a total
of 972 cases [36,56,49,43,44].

Other congenital lesions in association with pilo-
nidal sinuses are apparently very rare. Breidenbach and
Wilson found only one - a patient with club feet - in their
288 cases. Glenn [57] radiographed 19 patients with pilo-
nidal lesions and found spina bifida occulta in only two.
Kooistra atated that in his 350 cases the incidence of as-

sociated pituitary disease, mental defect, other congen-
ital anomalies and incidental disease, was insignificant.

Many clinicians feel that pilonidal lesions are
more common in persons who are obese and hairy, and the
early authors made particular note of this. Ottenheimer[58]
states that he is impressed by the number in whom an en-
docrine imbalance is suggested by body hair and fat dis-
tribution. It has been suggested that the preponderance
in males may be due to the greater amount of body hair in
the male [36]. The majority of writers make no mention
of this point however, and certainly many patients are
seen with pilonidal lesions who are neither obese nor
hairy. Ferguson and Mecray state that in their experience
there is no relationship.

Figure 1 is a photograph of a typical pilonidal
sinus as seen clinically. The skin-lined external open-
ing of the original sinus can be seen exactly in the mid-
line at the sacrococcygeal joint. A probe could be intro-
duced upward and toward the sacrum for approximately 3 cm.
A secondary sinus can be seen about 2 cm. upward and to
the left, in the medial part of the buttock. Probing of
both sinuses demonstrated a communication in the midline,
and both were discharging slightly. This is a 21 year old
male Canadian Navy veteran who had had symptoms of chronic
discharge and recurrent tender swelling for 22 months.

Fig. 1. - Typical clinical appearance of a
pilonidal sinus.

PATHOLOGY

Stone described a typical lesion in which inflammation had never occurred, and this is of sufficient rarity to be of great interest. He stated that the sinus was lined by stratified cuboidal epithelium with only slight cornification adjacent to the lumen, but with imperfect and rudimentary papillae in certain areas. Hair follicles were seen and also sweat glands, and the lumen contained hairs. Outside of the epithelial layer was a dense

corium-like sheath, and beyond this loose fat and areolar tissue. Some of the sweat glands lay in the fat at quite a distance from the lumen of the sinus. "In short the sinus is a slightly modified invagination of the true skin. None of its elements are fully developed - even the characteristic hair is thin, fine and scanty in pigment, somewhat like lanugo."

The vast majority of material removed at operation shows varying degrees of inflammatory reaction, with polymorphs, small round cell infiltration, large mononuclear cells, plasma cells, and foreign body giant cells. Sometimes the original epithelial structure of the lesion is entirely destroyed and replaced by granulation tissue, but usually some islands of epithelium are seen and occasional hair follicles, and sebaceous and sweat glands. The sinus is usually seen to end blindly in a sacculated pouch [32], but is often branched. Occasionally regenerating epithelium is noted [36]. Kooistra reports hair - usually dead and of fine texture - in the sinus or granulation tissue in 52%.

Granet and Ferguson state they have never found hair in a pilonidal cyst occurring without a communicating sinus, and no reports have been found of this occurring. They believe also that hairs growing externally insinuate themselves into the sinus opening and become broken off, but most authors agree that there are hair follicles present in the sinus itself to account for the hair which is

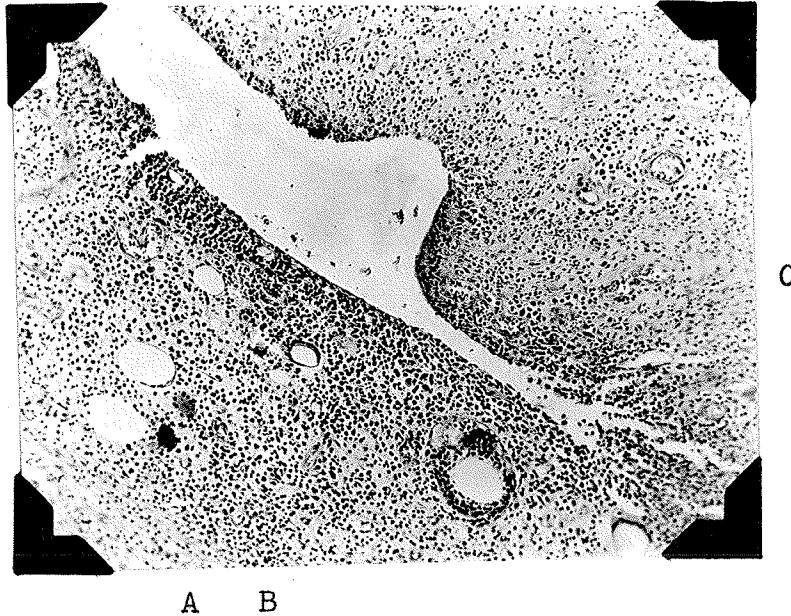found.   Figure 2 shows a typical section of an infected

pilonidal sinus.

Fig. 2. - Typical section of an infected
pilonidal sinus. The characteristic in-
flammatory reaction can be seen, with fo-
reign body giant cells above "A" and "B",
and an island of epithelium remaining op-
posite "C".   x75.

Bartlett[59] states that the great majority of

lesions are small, have few ramifications, and do not go

deep to the sacrococcygeal fascia, and Rogers [60] says

that 70% in his later series could be contained in a block

of tissue 2 x 2 x 5 cm. including skin.   These findings

are confirmed by Kooistra, Breidenbach and Wilson, and

others.   Brezin [61] states that fibrous cords fairly fre-

quently have to be followed up along the sacrum, and Weeder and others report cases of involvement of the sacrococcygeal joint by infected sinuses. Holman has reported the case of a sailor with recurrent symptoms following excision, in which at operation a tuft of hair was found projecting from the coccyx and section showed a sinus containing hairs right within the bony coccyx. Gage has reported the only case found in which nervous tissue was present in the section.

In "recurrences" there is usually found the same inflammatory reaction around granulation-lined sinuses in scar tissue, but sometimes epithelial elements and hair are present indicating incomplete removal of the lesion previously. Holman divides "recurrences" into four types:

1. Those in which infection occurs in abrasions of the delicate skin overlying the "poorly vascularised and therefore vulnerable scar tissue".

2. Those in which epithelial elements are left behind and form a nidus for infection.

3. Those in which invagination and inclusion of epithelial elements occurs in a prolonged healing process - he quotes a case in this connection where a single hair was found growing from a follicle in the wall of a dimple formed by retraction of scar during healing, and penetrating through the floor of the dimple and into the subcutaneous tissues for a distance of 4 cm.

4. Those in which dead space occurs in the wound and becomes infected.

Williams (62) states that even in the absence of epithelial elements the type of inflammatory reaction found around a pilonidal lesion is so highly characteristic that a diagnosis can be made from the section.

Organisms cultured from infected lesions are almost always Staphylococcus aureus, Bacillus subtilis, diphtheroids, or gram negative bacilli, alone or in combination.

Fig. 3. - Section of a "recurrence" due to infected dead space. Scar tissue can be seen at the bottom, and above this open spaces within a network of organising blood clot, surrounded by inflammatory reaction. Some of the spaces contain blood. No epithelial elements seen.   x75.

DIAGNOSIS

Diagnosis of pilonidal lesions presents no difficulty in the very great majority of cases. According to Stone no one who has knowingly seen one can make a mistake.

The condition most likely to be confused is fistula-in-ano, but proctoscopic examination and the fact that a probe passed into an anal fistula does not take a direction upward over the sacrum will be enough to differentiate in most cases. Injection of methylene blue into the sinus and observation of the anal canal, and injection of iodised oil and radiography (63,64) may be resorted to in more difficult cases.

A deep anal or post-anal dimple may be confused quite easily (Fig. 4), and in fact some believe that this is merely the same defect in a less marked degree. A probe passed here will point toward the tip of the coccyx. If symptoms are present treatment is almost the same in any case.

Osteomyelitis of the sacrum or coccyx with sinus formation is usually mentioned in differential diagnosis but must be very rare. Here a probe may "feel" bare bone, and x-rays will show bone involvement. It must be remembered that an osteomyelitis might be secondary to infection in a pilonidal lesion which extends deeply.

Furuncle, carbuncle and infected sebaceous cysts

Fig. 4. - Deep post-anal dimple. Probe
could be passed for 1.5 cm. and took a
downward direction toward the tip of the
coccyx, which was bent backward. Male
aged 39 years - had had no symptoms from
dimple. Had excision of posterior anal
fissure 13 days before photograph taken.

are rare in the sacrococcygeal region but might conceiv-

ably be confused. The first two are extremely unlikely

to recur in the same location following healing, and the

third might recur but would be recognised on excision.

Tuberculous and luetic lesions should be recog-

nised by associated lesions elsewhere, serological tests
and x-ray.

Traumatic dermoids and implantation cysts, lipo-
mata and fibromata - and the rare tumors which occur in
this area such as chordoma, teratoma, neuro-epithelioma,
neuroblastoma, and paraganglioma originating in the coc-
cygeal gland of Luschka - would usually have to be dis-
tinguished by excision or biopsy. X-ray also should be
of value in some cases. That these rare possibilities
should be kept in mind is shown by a case of Fried's and
Stone's cited by Fox in which a fistula was treated for
years as an anal fistula causing perirectal abscesses un-
til microscopic section unmasked a chordoma. Ferguson
and Mecray state that one of their cases had a "pilonidal"
abscess incised four times before a sinus tract was found
perforating the sacrum from a large dermoid cyst on its
anterior surface which was demonstrated easily by x-ray.

ANATOMICAL CONSIDERATIONS

The region of the natal cleft is commonly all but
ignored in works on anatomy. Situated as it is between
the large rounded protuberances of the buttocks, and cur-
ved to follow the posterior surfaces of sacrum and coccyx,
it presents very unusual features from the standpoint of
surgical anatomy.

The skin of the buttocks is fairly thick, and as

a rule is devoid of conspicuous hairs except toward the
post-anal furrow, where in some males they are abundant-
ly developed. Superficial fascia is thick and fatty over
the buttocks, but considerably thinner in the natal cleft.
Gray (65) states: "beneath the fatty layer there is gen-
erally another layer of superficial fascia, almost devoid
of adipose tissue, in which the trunks of the subcutan-
eous vessels and nerves are found". The deep fascia of
the area is part of the fascia lata, which is attached to
the spinous processes of the sacrum and to the coccyx, and
to the iliac crest. The posterior surface of the coccyx
is covered by the posterior sacro-coccygeal ligament, and
the posterior surface of the lower sacrum is covered by
parts of the sacrotuberous and sacro-iliac ligaments. Lig-
aments are strong, tough, and almost avascular, as is deep
fascia.

It is commonly considered that there is an abun-
dance of skin and subcutaneous tissue in the sacrococcygeal
region, but it is only necessary to observe carefully this
region in a person who is stooping over, or sitting on a
stool and leaning forward to lace a shoe, to realise the
tension that exists normally in these positions of the body.

If the buttocks are spread apart and the skin of
the natal cleft pulled in various directions with the fin-
gers it is at once obvious that it is held down firmly to
the underlying bone and very little excursion is possible
in any direction.

The accompanying drawing (Fig. 5) was made from
a fresh cross section of this region taken at autopsy
where there had been no abnormality of the region during
life. The very strong fibrous bands binding the skin in
the midline down to the upper end of the coccyx may be
seen, as well as bands radiating outward, and bands par-
allel to the skin surface binding the superficial fascia
of the two buttocks together. These strong bands will be
sectioned and largely removed at operation for pilonidal
lesions in which a block of tissue is removed. Their
presence was first noted at operation when the lateral
edges of wounds in this area were seen to gape widely as
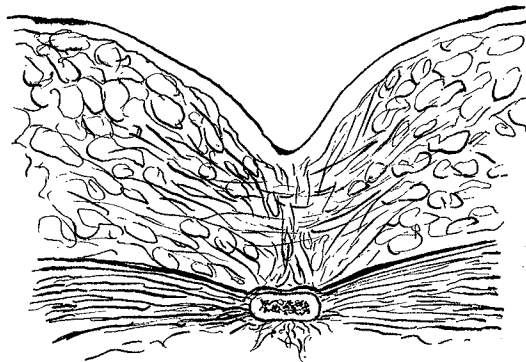soon as a section of tissue was removed.

Fig. 5. - Drawing of cross-section of
tissues at level of upper end of coccyx
- from fresh specimen at autopsy.

TREATMENT

As with the etiology, the treatment of pilonidal disease presents an interesting problem, and the number of different procedures advocated is eloquent testimony to the unsatisfactory state of our knowledge. Rogers [60] sums it up by saying "---- to the surgeon it presents essentially the problem of making a wound heal in a place where it does not want to heal. Patients will be cured and will fail to be cured by all the methods of treatment described in the literature, and some of the cures will be brilliant and some of the failures will be most distressing".

The earliest writers advocated surgical eradication by excision, curettement or cautery [25,3,66], and this is still almost universally recognised as the only proper treatment. Apart from a very few, who advocate special procedures, the vast majority of surgeons who have written on the subject recommend complete excision of the lesions and either allowing the resulting wound to heal by granulation or closing the wound in the expectation of healing by first intention. The former procedure permits the minimum of essential variations, but the number of different methods advocated to procure primary healing in pilonidal wounds is legion.

The cooperation and understanding of the patient is extremely important in the treatment of pilonidal disease - perhaps bearing a more direct relationship to the

results obtained than in any other of the common surgical procedures. It is not uncommon - indeed is the rule rather than the exception - to have the patient assume that since it is a small lesion, it should be correspondingly easy to cure. Time spent in carefully explaining to the patient the nature of the lesion, and the operation of factors responsible for delay in healing, as well as the length of probable hospital stay and loss of time from work involved, is always well spent.

An attitude of great care and meticulous attention to detail on the part of the surgeon, in pre- and post-operative care as well as during operation, is almost the sine qua non of good results. It is safe to say that such an attitude if not at first present will rapidly become evident in those who are operating on more than a very few cases of pilonidal disease.

For convenience in the consideration of treatment patients may be divided into several groups:

1. Those with acute infection in the sinus tracts, with abscess formation or cellulitis.

2. Those presenting with the usual symptoms of chronic discharge, irritation, tenderness and pain of milder degree, which group comprises the majority.

3. Those with recurrence of symptoms following excision.

4. Those with rare or unusual manifestations. The first three groups do not differ greatly because following palliative treatment the first merges into the se-

cond, and the great majority of the third group may be
treated similarly to the second group.

It is universally agreed that no active treatment
should be contemplated during an acute infection in pilo-
nidal sinuses or cysts, or in recurrences which are acute-
ly inflamed, with the exception of incision and drainage
of abscesses, which may include "unroofing" of large ab-
scess cavities and packing with gauze to promote granula-
tion and facilitate drainage. If the infective process
has been severe enough to destroy all the cyst and sinus
walls this may in some cases be followed by complete and
permanent healing. Actual marsupialisation of the abscess
cavity has been described, by cutting away the overhanging
edges and suturing skin edges to edges of abscess wall (55).

Subsidiary measures such as rest, hot sitz baths,
foments, chemotherapy, heliotherapy, diathermy, and gener-
al supportive measures are all important during this phase.

Definitive surgery following subsidence of acute
infection is undertaken after varying periods of time, some
authors proceeding in a few days (36,42,67,56) and others
recommending periods up to several months (59,58) in order
to allow the tissues to completely overcome any lurking in-
fection. Waiting too long of course exposes the patient to
the risk of another acute infection, as well as postponing
the ultimate cure. It is important to be sure that the pa-
tient understands that incision and drainage is merely a
temporary measure to palliate the acute process, and that

subsequent operation will be necessary (68).

The second group as stated above comprises the great majority of cases, and when taken to include for the sake of consideration of treatment all of the first group when acute inflammation has subsided, and the third group with the exception of those relatively few in which scarring is especially widespread, makes up about 90% or more of all cases seen (36,60). These are the so-called "typical" cases for the treatment of which so many methods have been devised, and in which results are all too often disappointing.

The injection of sclerosing solutions into the sinus tracts in an effort to destroy the epithelial walls and produce granulation and healing has been advocated by several authors, and it is interesting to note that Anderson in his case in 1847 tried the injection of mercuric chloride and silver nitrate but finally had to open the lesion and curette the walls after removing the hair. J. K. Anderson writing in 1931 (69) also mentions that these can be used but only in uncomplicated cases, and prefers to excise the lesions. Biegeleisen (70) quotes three cases with good results in which he used fuming nitric acid, and Cutler and Zollinger (71) recommend the use of a modified Carnoy's solution. Crookall (72) packed the sinus tract with crystalline silver nitrate. These methods have not gained wide acceptance because of their unreliability due to the difficulty of destroying all of the epithelial walls.

Maillard [73] was the first to use electricity. He reported a case treated by successive applications of galvanic current who remained at work throughout treatment for three months and was completely cured at six months after the termination of treatment. Electrocautery has been used in excision by Stanton [74] and by others notably Rogers, whose contribution is considered at greater length below. Smith [75] has suggested the use of roentgenotherapy in recent cases as an adjunct to surgery, to prevent hair growth from interfering with healing, and to control infection.

The use of sclerotics or electricity as above is an attempt to cure the patient while he is ambulant, but the great majority of surgeons still favor hospital treatment for these cases.

Complete surgical excision of all primary and secondary sinuses and cystic spaces is recognised universally as the ideal method of treatment. This is usually carried out by enclosing the sinus openings between two elliptical vertical incisions and carrying the dissection down to the deep fascia over the sacrum and coccyx, to include all diseased tissue. Some state that it is essential to remove a wedge of tissue en bloc, which will include normal tissue for at least one half-inch on each side of the diseased tracts, in order to be sure of extirpating infected hair follicles and sebaceous and sweat glands in association with them and also to avoid contamination of the wound by cutting

across the infected tracts [43,68,76,77,78]. Others carry
out a very careful dissection of the diseased tracts only,
and decry any sacrifice of normal tissue in this region
because of difficulty of closure [56,59,60,61]. There are
advocates for bevelling of the edges of the wound both in-
ward and outward in order to facilitate closure, or to pro-
mote healing by granulation.

It is essential to remove all diseased tissue, and
if there is involvement of the posterior sacral or coccy-
geal ligaments or of bone the affected parts must be re-
moved. Weeder advocates removal of the coccyx and curet-
ting of the sacrococcygeal joint in all recurrent cases,
where the sacrococcygeal ligaments are discolored by dye,
or where the character of the tissue at the sacrococcygeal
joint is under suspicion or shown to be involved by lipio-
dol injection and x-ray. Granet and Ferguson stress the
importance of not excising deeper than the deep fascia in
the great majority of cases, as this is a comparatively
vascular layer and will facilitate healing in the depths
of the wound, whereas the posterior sacrococcygeal liga-
ments are almost avascular and cannot be expected to unite
firmly to a vascular layer such as the fat-fascia flap.

The procedure to be adopted following excision
ranks with the etiology of these lesions as a subject for
controversy. Perhaps the majority of surgeons still feel
that leaving the wound open to heal by granulation offers
the best insurance against recurrence and offsets the dis-

advantages of longer healing time, greater nursing care required, and larger scar [36]. Kleckner [79] in 1936 communicated with a number of surgeons and collected information regarding 4699 patients. 4231 of these had been treated by excision and their wounds packed open, whereas only 468 had been sutured. Rosser and Kerr [80] very recently report that in a questionnaire addressed to thirty-five proctologists who had served in the armed forces of the U.S., 77.7% of the twenty-seven replies they received favored packing the wound open after excision as a general rule to be followed in private practice. Though the great majority of more recently published articles deal with various methods of primary closure, several authors state that packing the wound open is the only proper method of treatment in this area where infection is always present [45,48,60,77].

Minor variations in technique are recorded with respect to packing material used and post-operative care of the patient. Most use dry gauze, iodoform gauze or gauze impregnated with vaseline or penicillin cream. The local use of sulfonamides in powder form is advocated, and the frequent use of various irrigating solutions such as Dakin's solution, azochloramid-in-triacetin 1:5000 [49], and hydrogen peroxide. The use of heliotherapy [47] and x-radiation [81] to the open wound are suggested, and Blaisdell and others stress the importance of very careful surveillance of the healing wound and correction from time

to time of any tendency to bridging or pocketing of the
granulations or healing with overhanging edges. Skin
grafting immediately or after curetting sluggish granu-
lations has been recommended (39,49,82). All these
measures are worth consideration in certain cases but
the greater number will granulate in very well and epi-
thelialisation will proceed over the scar with daily
packing and irrigation of the wound. Frequent hot tub
baths are of great value in keeping open wounds in this
area clean and healing well.

The technique of Rogers is an unusual variant of
this method and worthy of special mention. He excises
the sinus tracts and cysts with electrocautery, using a
very fine blade and dissecting rather than excising the
diseased tracts with a block of normal tissue. The wound
is then packed with dry gauze and the patient carries on
with his work, reporting regularly for dressings, at which
time any necessary revision is carried out by the same
technique. He states that over 90% of cases of pilonidal
disease can be treated successfully in this way.

Many surgeons who ordinarily favor primary closure
for the average case feel that packing the wound open
should be practiced without exception in cases of recur-
rence, and most others are inclined to be more exacting in
their criteria for primary closure when dealing with a
recurrence.

Primary closure of the wound following excision

with the expectation of healing by first intention is the ideal treatment of pilonidal cysts and sinuses, because of shortened healing time, minimum of dressings and nursing care required, and small size of the resultant scar. Unfortunately however, this method has always been subject to a higher recurrence rate than the "open" method, and many different techniques of closure have been advanced with the claim by their authors that superior results are obtained.

The method described by Colp is perhaps the prototype. After a vertical elliptical block excision he undercuts the lateral flaps along the glutaeal fascia and approximates the flaps by means of deep mattress sutures through the posterior sacral and coccygeal ligaments, alternating his sutures from either side. The skin edges are then approximated and sutures left long and tied over a gauze roll to produce pressure on the suture line when adhesive strapping is applied. A diagrammatic sketch is appended to illustrate the technique (Fig. 6).

A modification of Colp's method is frequently used in which additional deep through-and-through sutures are passed including the posterior sacral and coccygeal ligaments, and tied over a gauze roll instead of merely the skin sutures being so tied.(Fig. 7).

Lahey [83] advocates an elliptical incision lateral to the wound, the intermediate double-pedicled flap then being stripped off the glutaeal fascia and swung over, being
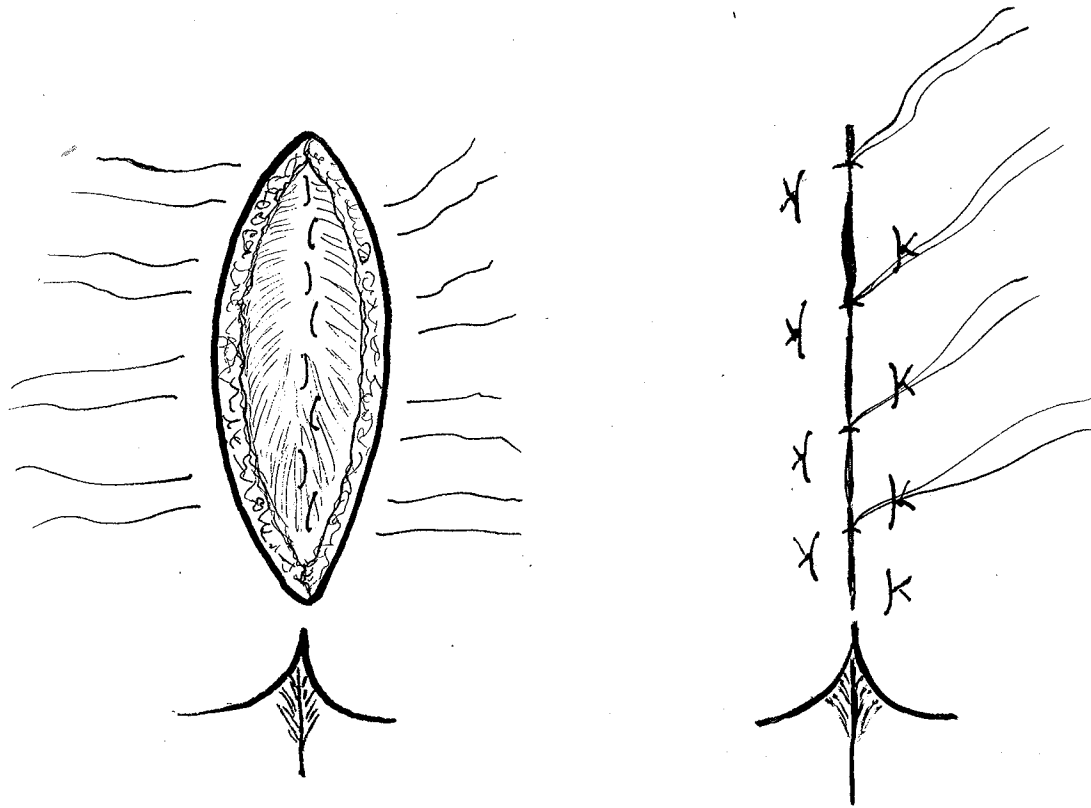
Fig. 6. - Colp's method of primary closure.
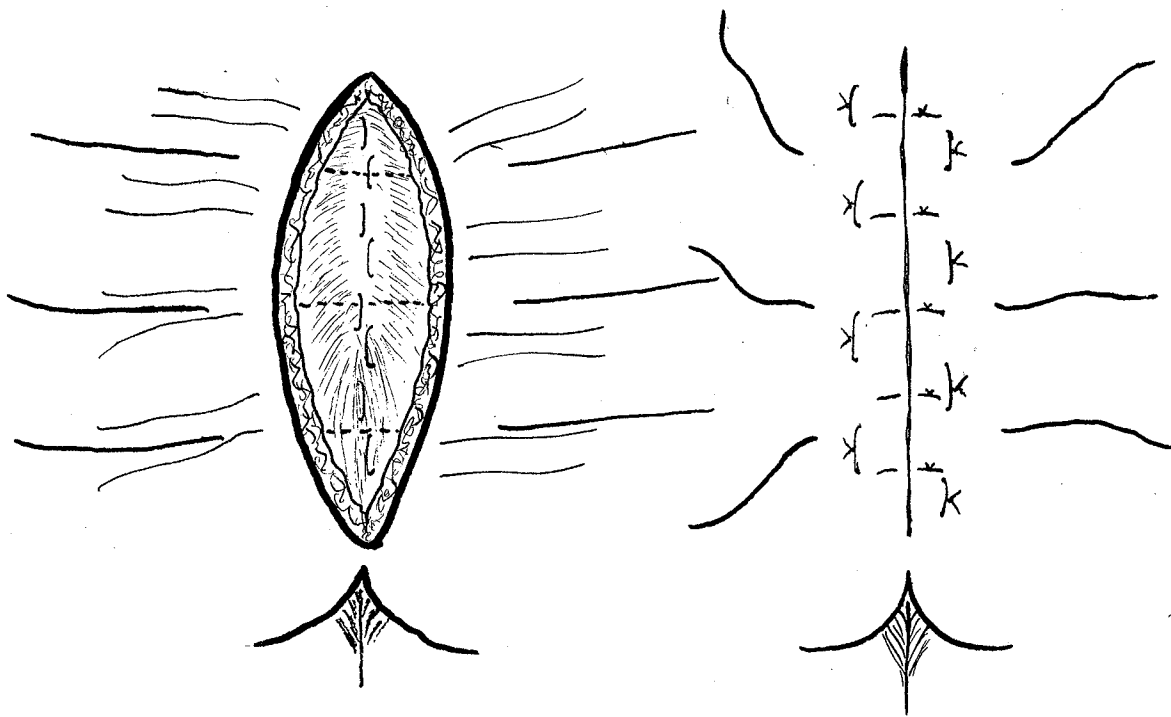Long ends of skin sutures are tied over a
gauze roll.

Fig. 7. - Modification of Colp's method.
Ends of deep sutures tied over gauze roll.

sutured in the midline to close the original wound, and accepting the defect laterally where the soft fibres of glutaeus maximus form a more suitable base for the subsequent scar than the unyielding bone of the sacrum (Fig. 8). A variation of this technique which is commonly practiced in suitable cases is to close the lateral wound by secondary suture after healing of the midline wound. Occasionally a similar relieving incision is made on the other side and a flap raised, the two flaps then being sutured together in the midline to close the original defect and leaving two lateral wounds.

Cattell and Stoller [84] advocate a modification of Lahey's operation in which the lateral incision is made in the form of a "V" and sutured in the form of a "Y", partially or completely (Fig. 9).

Holman considers that recurrences are often due to strangulation of fatty tissue deep in the wound by encircling deep sutures and recommends closure of the fatty flaps by successive layers of chromic catgut, and the skin by a subcuticular suture to avoid introduction of infection into fat. He obtains hemostasis by digital pressure only, using no ligatures.

Brezin reflects "U"-shaped or rectangular flaps, of skin only, leaving small islands of skin around sinus openings, and planned in each individual case. The sinus tracts and cysts are then very carefully dissected out with no sacrifice of normal tissue, the fatty layer closed by a few sutures and the skin flap sutured back into place and "but-
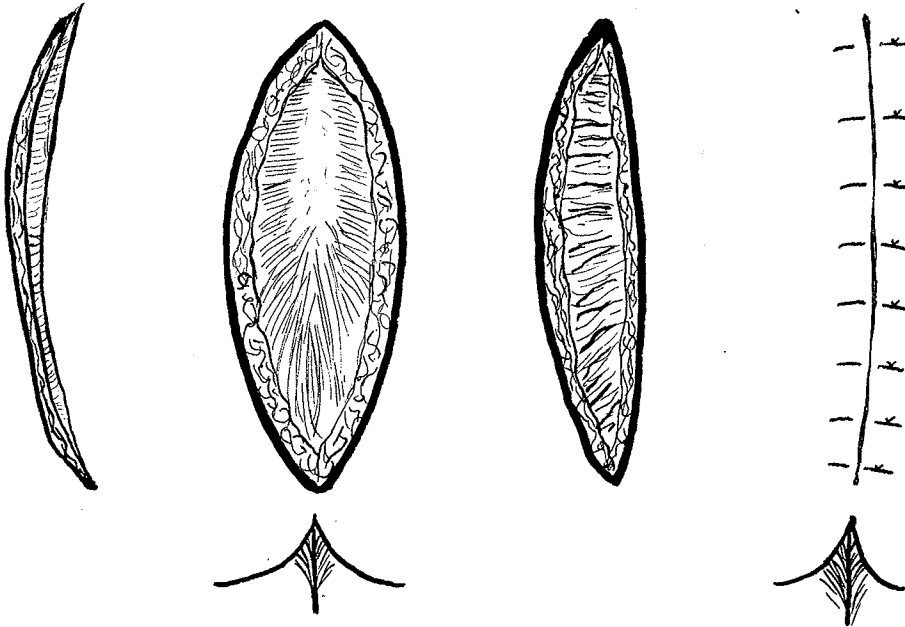
46

Fig. 8. - Lahey's method. Double pedicled
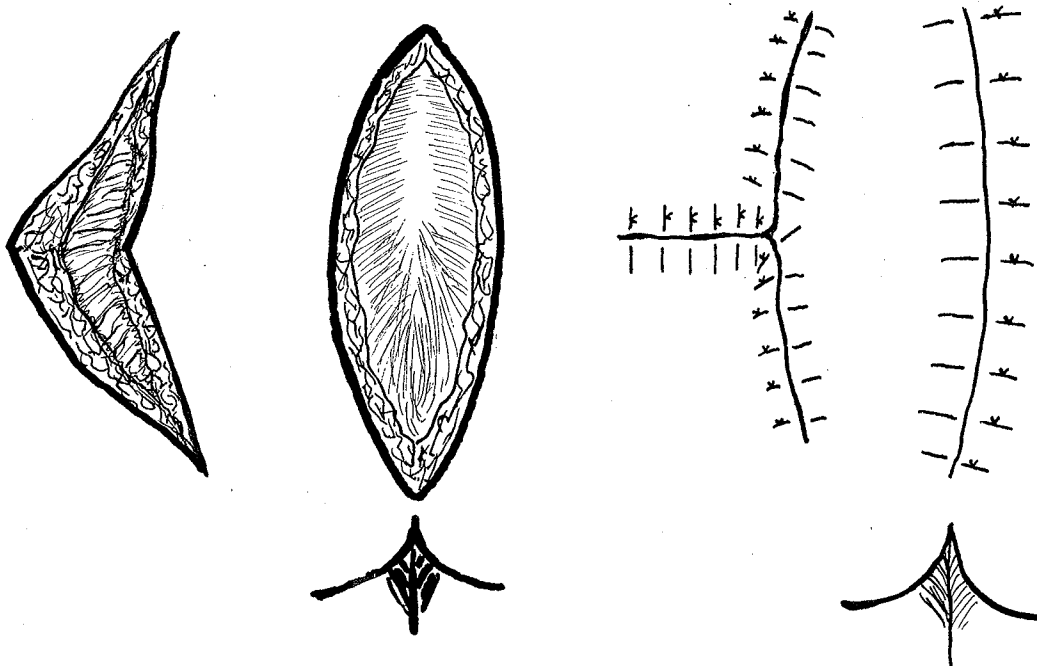flap swung over to close central wound.

Fig. 9. - Cattell and Stoller - "V - Y"
method of closing central defect.

ton-holes" sutured. He also advocates the use of an oint-
ment of sulfathiazole, cod liver oil and lanolin in the
depths of the wound and on all suture lines, as part of
his method.

Scarborough [82] recommends primary skin grafting
to close the defect unless primary closure is very easily
effected.

Ottenheimer has suggested the use of bilateral
"butterfly wings" of musculo-fascial tissue to close the
depths of the wound and promote healing, and Shute et al[76]
describe a similar operation in which an incision is made
on each side into the glutaeus maximus and the medial mus-
culo-fascial flaps turned medially and sutured together,
then the lateral flaps undercut in the muscle itself and
mobilised and sutured in the midline (Fig. 10).

Larkin [85] uses deep through-and-through sutures
of stainless steel wires tied over gauze rolls and a rubber
sponge, and also uses fine wire for ligatures and washes
out the wound carefully with hot saline for hemostasis and
removal of loose pieces of tissue. He undercuts laterally
through the fatty layer, leaving only a small amount of
fat attached to the skin flaps.

Ferguson and Mecray tie stainless steel wire deep
through-and-through sutures over gauze rolls on either
side after block excision with local anaesthetic, close
the deepr layers with plain catgut through the sacral and
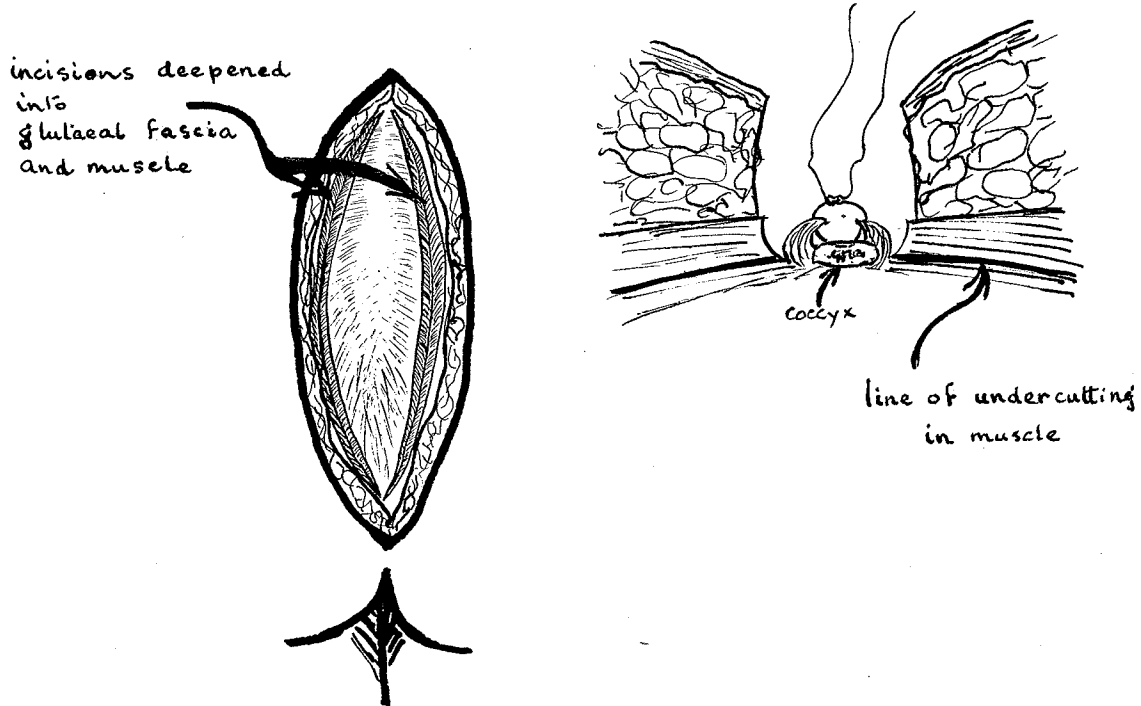coccygeal ligaments, and allow the patient to go home an

incisions deepened
into
gluteal fascia
and muscle

coccyx

line of undercutting
in muscle

Fig. 10. - Operation described by Shute,
et al, using musculo-fascial flaps.

hour after operation.

Where the defect is wide or for other reasons dif-
ficult to close by ordinary methods a large buttock rota-
tion flap may be used as described below.

Babcock [78] suggests that in many cases time would
be saved by secondary suture.

Partial closure of the wound after excision has been
advocated by some surgeons in an effort to reduce the heal-
ing time of the open wound, but in the past most have felt
that the healing time is insignificantly reduced and at the
same time the recurrence rate is increased due to the pro-
duction of an infected space with a "bottle-neck". Rogers

states that partial closure is an indication of weak
judgement - those that would do well should have had
primary closure, those that do poorly should have been
packed open. There are many variations depending on
the individual case, a few sutures baing placed at one
or both ends and the central part of the wound packed,
and so on. Several special techniques are reported.

LaRochelle [86] closes the skin only and cutting
two eyes near the center of a 12" piece of 3/8" rubber
tubing carries it across the wound through two tight
lateral stab wounds. This is left in place for 5 - 7
days and used for hourly irrigations with 1:5000 meta-
phen.

Morter [87] places deep through-and-through silk-
worm gut stay sutures under the sacral and coccygeal liga-
ments, packs the wound with gauze soaked in 3% mercuro-
chrome projecting at one end, sutures the skin, and ties
the stay sutures over all. After 24 hours stay sutures
and gauze are removed and the wound irrigated with Dakin's
solution b.i.d. for 3 days followed by dry dressings.

MacFee [88] recommends mobilisation of lateral
skin flaps which are then pulled down over the edges of
the fatty layer and sutured directly to the sacral and
coccygeal ligaments near the midline, a narrow space being
left to granulate in (Fig. 11).

Theis and Rusher [89] place deep through-and-
through stay sutures including the sacral and coccygeal
ligaments, place two or more rows of sutures in the deeper

tissues, and pack open the skin only with a strip of iodoform vaseline gauze which is left in place until extruded by granulations in 5 - 7 days. They feel this is important to allow escape of "wound secretions" and collections of serum or blood.

It is felt by many (53) that if gross inflammation occurs in a wound which has been partially closed or even one primarily closed, it can always be opened by removal of sutures and treated then as a wound packed open from the first, so that nothing is lost. However, this is not always true, as partial healing may have occurred before gross infection becomes evident, with resultant bridging and pocketing. In such cases another operation of greater or lesser severity will be necessary, and this often cannot be undertaken at once because of acute local or general reaction to infection.

An alternative to destruction or excision of the sinus tracts and cyst walls is partial removal and marsupialisation, as advocated by Buie and later Brockbank and Floyd. They place a grooved director in the sinus tracts and open down on them, then removing all but the bases of the sinus and cyst walls which are usually attached to the deep fascia. The overhanging skin edges are also removed, and a wedge of subcutaneous tissue to prevent bulging. Skin edges are then sutured to edges of cyst and sinus walls. They claim that the lining epithelium of the lesion rapidly takes on the appearance and functions of external

skin, and that even when replaced by infected granulation
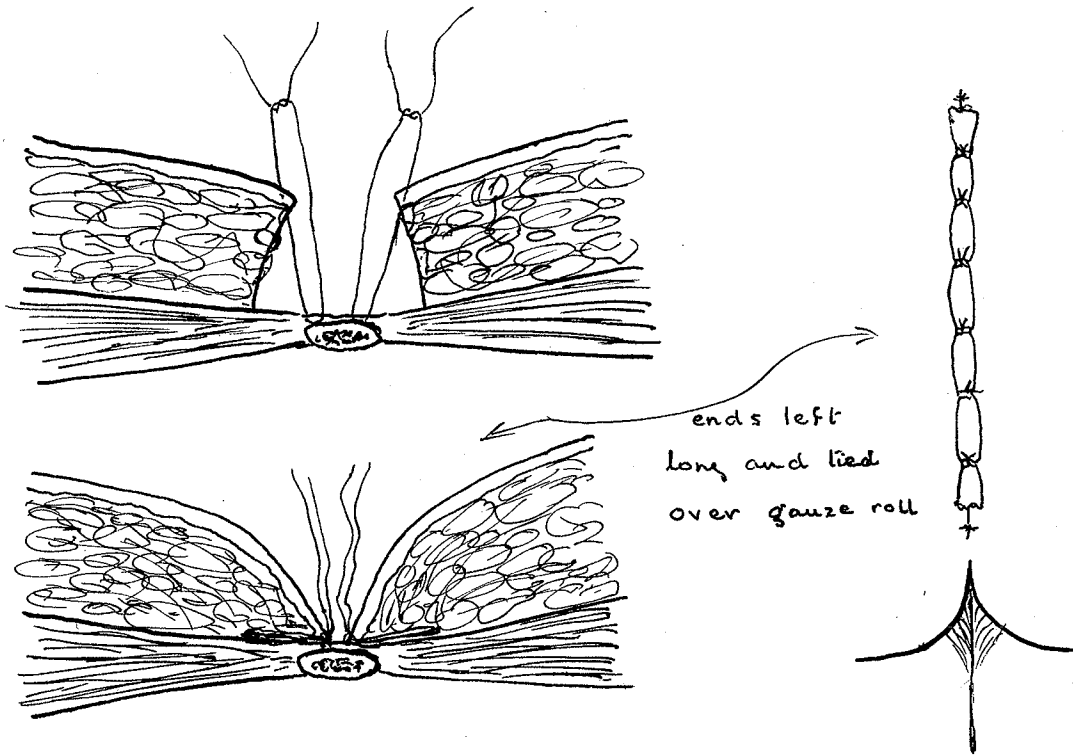tissue it rapidly becomes epithelialised. (Fig. 12)

ends left
long and tied
over gauze roll

Fig. 11. - Method of partial closure
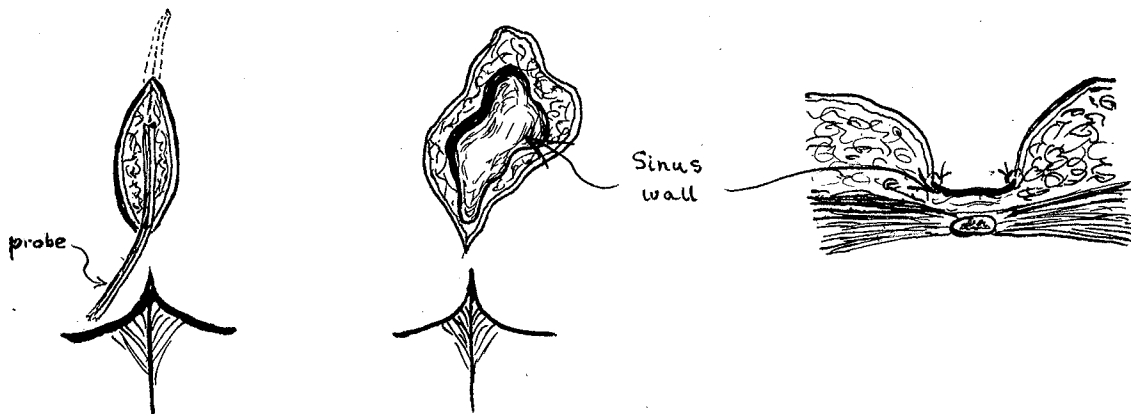described by MacFee.

probe

Sinus
wall

Fig. 12. - Marsupialisation of sinus as
described by Buie and Brockbank and Floyd.

There remains for consideration the type of case,
comprising about 10%, which does not fall into the pre-
ceding groups, and in which treatment must be suited to
the individual case.

The most common type of case which will require
special consideration is that in which as a result of
excision there is an unusually large defect, such as will
be encountered if the sinus ramifications are exception-
ally extensive, or if previous surgical treatment has
left a large scar which must be excised. Here some type
of advanced plastic procedure is usually necessary, as
simply allowing the wound to heal by granulation will
result in a large scar which will very likely give rise
to trouble, and closure by the ordinary methods is not
possible. A method devised by Merkeley (90) which applies
the principles of plastic surgery in closure of defects,
has proved very successful in a small series of cases. A
large buttock rotation flap is used as illustrated (Figs.
13, 14) after careful hemostasis, the defect being closed
by means of taking a slightly larger space on the flap than
on the surrounding skin when placing sutures. A small pen-
rose drain is placed in the depths of the central area of
the wound through a stab in the opposite buttock. The
rather extensive linear scar gives rise to no discomfort
and is in the "bathing trunk area" so that no cosmetic dis-
ability results. A flap might be rotated from each buttock
but the necessity for this would rarely if ever arise in

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Fig. 13. - Large scar following excision -
superficial breaking down in center from
tension and pressure.

Fig. 14. - Same case as in fig. 13, two
weeks after buttock rotation flap had been
swung into defect following excision.

pilonidal surgery.

Bizarre patterns of secondary sinus tract formation will require special treatment. These will usually be found in the buttock on one or both sides, or in the perinaeum as a result of burrowing into the ischio-rectal fossa. Very rarely a sinus opening has been found in the groin on thigh. Here excision of the local lesion in the sacrococcygeal region will have to be accompanied by excision of the secondary sinus or sinuses wherever they may lead. The whole wound with its lateral extensions may then be packed open, or the original wound closed by one of the usual methods and the lateral extensions packed open to heal by granulation. Occasionally it may be possible to suture also the lateral extensions and obtain healing.

Communication of the sinus tracts with the spinal canal has been described but is extremely rare. Infection in these sinuses usually results in signs and symptoms of meningitis or subdural abscess, and treatment is directed against the complication rather than the original lesion. There is very considerable doubt as to whether these lesions can truly be classed as pilonidal. Moise's case recovered following excision of the sinus and laminectomy. Gage's case (as quoted above) was treated by packing with iodoform gauze and sutured loosely, and recovered completely.

Each surgeon has of course his own favorite pre- and post-operative regime and peculiarities of procedure at operation. All agree on the necessity for adequate pre-

paration, and carefully supervised post-operative care.

All types of anaesthesia are used, and advantages claimed for each. Most avoid local infiltration and caudal analgesia because of the danger of spreading infection from the lesion itself. Some however prefer to use local infiltration or field block exclusively (42,59,60). Spinal anaesthesia is preferred by most.

Pre-operative preparation of the skin is considered important by LaRochelle, who uses repeated scrubbing and 1:5000 metaphen. Most surgeons use a routine much like that of Ottenheimer, who prescribes castor oil at h.s. the night before and a cleansing enema the morning of operation, the patient then being placed on a liquid diet and given Tr. opii to prevent movement of the bowel for 6 days after operation.

Ottenheimer also keeps the patient lying prone or on his side for 14 days post-operatively in order to prevent stretching of the wound by sitting, or lying on the back. This principle is embraced by most surgeons, and some forbid sitting down, lying on the back or stooping over for 6 weeks or more after operation.

Pressure on the operative site is considered important by all, and is usually brought about by the application of adhesive or elastoplast strips over gauze rolls. Breidenbach and Wilson advise the use of marine sponges under adhesive strips for this purpose. The great difficulty of procuring pressure in this region is illustrated by the accompanying diagram (Fig. 15) and

it is doubtful if any of the usual forms of dressing actually applies pressure to the wound. Indeed in many cases the reverse must be true. Perhaps securing the ends of the strips well past the anterior iliac spines helps.
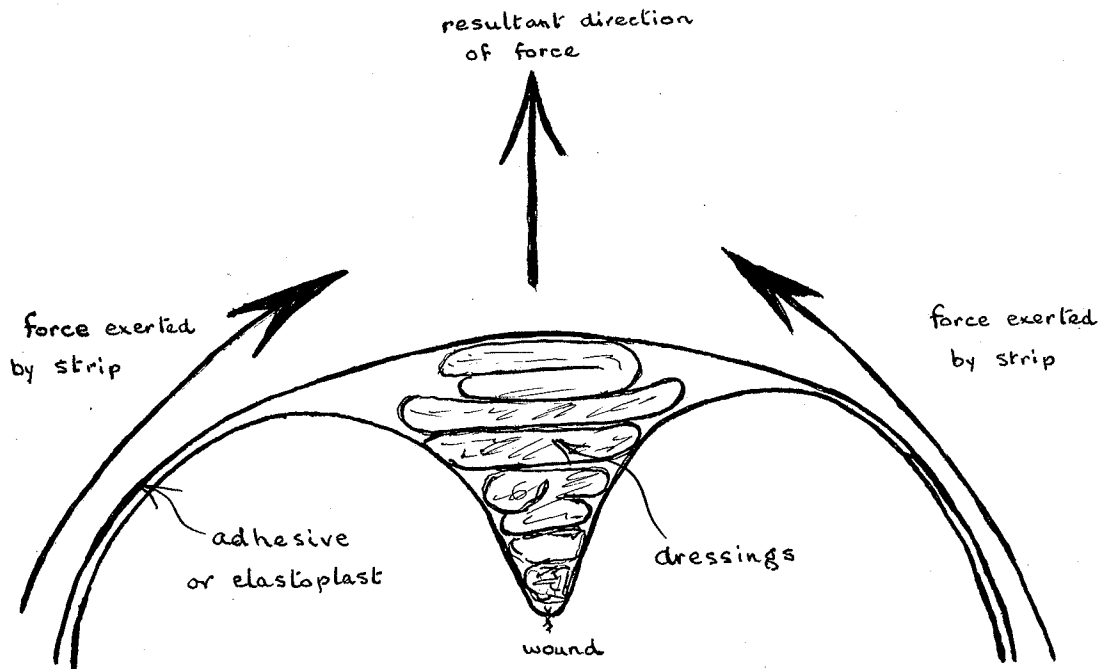
Fig. 15. - Diagram to illustrate the forces in operation when adhesive strips are applied in an effort to create pressure on wound.

Operation is almost universally performed with the patient prone and a pillow under the groins or the table broken at this site. Strapping the buttocks apart by wide strips of adhesive to the edges of the table applied before preparation and then painted with the skin, facilitates exposure.. These can be cut before closure to reduce tension.

The injection of a dye into the sinus to delineate diseased tissue and facilitate removal is advocated by most surgeons. Methylene blue is much the commonest, in aqueous or ethereal [78] solution, or in a mixture with hydrogen peroxide [29] or paraffin. Paraffin alone is used by some to distend and stiffen the tracts [48]. The disadvantages cited are that it gives the surgeon a false sense of security because some of the sinuses may be blocked and not stain thus perhaps being left behind, and that normal tissue may become stained as a result of poor technique and result in wider excision than is necessary. Rogers states that section of tissues removed showed that dye thought to be in ramifications of sinus tracts at operation, was in reality in perfectly normal lymphatic channels. Bookman recommends emptying the tracts by pressure, purse-stringing a cannula into the sinus opening, and injecting carefully under considerable pressure accompanied by massage of the area. Scott advises injection 2 or 3 days before operation in order to avoid spilling of the dye from tracts at operation and staining of normal tissue. Those who decry the use of a dye state that an experienced surgeon has no difficulty in telling what tissue is diseased during dissection.

Graham [91] uses an electric cutting current to open the sinus and coagulates all surfaces as a preliminary to excision to avoid contamination of the wound. Others clamp the two central skin edges together over the sinus openings before completing removal of the infected

tracts. Babcock injects a saturated solution of zinc chloride to sterilise the tract.

Complete hemostasis is generally recognised to be important as blood clot forms a favorable nidus for infection. It may be obtained by clamping and tying, electrocoagulation of bleeding points, digital pressure or hot packs. The topical use of thrombin preparations would seem to be indicated here, if difficulty is encountered. Wholesale ligaturing of vessels and tissues is to be avoided because of the increased chance of infection occurring in a wound containing small areas of necrosis and foreign material. Careful debridement and removal of loose pieces of fat and other tissue by repeated saline irrigations before closure is recommended [85].

Suture material used varies considerably but most prefer to use absorbable material in the deeper tissues. Dunphy and Matson [92] prefer to use silk because of the decreased tissue reaction obtained, and Kooistra's figures support their theory. Steel wire is used by some for the same reason [76].

Most operators feel that draining the closed wound is inviting disaster because of the necessity of leaving a sinus tract when the drain is removed which may lead to recurrence, and also because of the chance of infection entering along the drainage tract. A small soft rubber drain is used by some, at the upper end of the wound where recurrence is less likely to result.

Since the advent of chemotherapy sulfonamides and penicillin have been used both locally and systemically in the treatment of pilonidal lesions. Few now use them locally because it is felt that they increase the tendency to serum formation in the wound (49,76). The same criticism would apply to the use of oxidised cellulose products recently on the market for control of bleeding. Scott recommends the use of buffered sulfanilamide locally before closure and Camp and Polites and Holman stress the use of local sulfonamides. Systemic use of sulfonamides and penicillin is almost universal. Larkin recommends large doses of cevitamic acid post-operatively to promote wound healing.

The importance of continuous treatment of any case "by one surgeon from start to finish" is emphasised by Rogers, who insists on this plan at the Massachusetts General Hospital Out-patient Department. Apart from the proprietary interest in a case one has operated upon personally, the importance of knowing exactly what has been done before cannot be denied when subsequent care and dressings are under consideration.

An outline of treatment would be incomplete without reference to prophylactic treatment. Stone reports a case which he was "fortunate enough to discover and remove cleanly" before it had been inflamed at all. He considers this good practice and not meddlesome surgery because of the certainty of development of symptoms later and the ease of removal and expectation of primary healing where there is no infection. Ottenheimer advocates removal in children

before infection has occurred if the sinus admits a probe, because symptoms are almost bound to occur in later life when excision is attended by much greater difficulty and results in much greater economic loss. Most surgeons will hesitate to advise radical treatment before symptoms have appeared in the face of the present rate of recurrence and delayed healing. A consideration of the reported percentages of appearance of post-anal defects in children and adults will give pause to those who may be inclined to follow Ottenheimer's lead.

RESULTS

The exact results obtained in pilonidal surgery are difficult to assess from reports. Rogers states that "there is a dearth of figures but general impressions are freely recorded".

Any result less favorable than a well healed symptom-free scar must be considered a failure in some degree, but the most frequent and dramatic failure is the so-called "recurrence", in which the patient presents in a varying time after definitive surgery with a discharging sinus in or about the operative scar and a return of some or all of his original symptoms. This is more common in wounds that have been sutured but also occurs in those that have been packed open. Delayed or prolonged healing is another form of failure; as is breaking down of the scar; soreness, tenderness or aching in the scar; itching and irritation

and numbness in the scar; and in the case of wounds pri-
marily closed, gross inflammation necessitating removal
of sutures and further treatment as an open wound.

The wound which is packed open is subject parti-
cularly to delayed healing and subsequent trouble with a
large scar, but the average patient can usually return to
his occupation a week or ten days following operation and
report for necessary dressings. The wound closed at oper-
ation or secondarily closed is particularly subject to
"recurrence" and early failure due to gross infection, but
healing time in successful cases is short and time away
from work usually averages about 3 weeks.

Recurrences were formerly thought to be due to
incomplete removal of ramifications of the sinus tract
and some authors still adhere to this view [6,34], but
the great majority now consider that infected dead space
in the depths of the wound is the cause in practically
all cases [58,76,81]. Dead space may be left at operation
by faulty technique or result from the use of a drain or
closure of the wound under tension, but the majority
occur as a result of poor healing in the depths of the
wound and subsequent trauma which may be very slight.
As Ottenheimer says - "Even in a well-healed wound we have
nothing but skin, an unstable scar in a deep layer of fat,
and bone. With constant pressure as in sitting, or an
acute injury, the scar may break first in the fat adjoin-
ing the bone which results in a dead space possibly with

a small hematoma. The dead space eventually finds its way to the skin and becoming infected presents a picture closely resembling the original pilonidal sinus."

Holman ascribes failures in this particular region to moisture, heat, motion and trauma. Ottenheimer states that delayed healing is due to the type of patient who has pilonidal disease, operation too soon after acute infection, unavoidably unfavorable location of the wound, imperfect hemostasis and incomplete excision, in that order. He adds that failure to remove infected sacrococcygeal fascia may often be a cause. Morter states that "clots in the wound assure 100% failure", and considers contamination of the wound by cutting into a sinus a frequent cause of infection in closed wounds. Granet and Ferguson, and Bernstein, ascribe most recurrences to faulty healing in the depths of the wound as a result of removal of the sacrococcygeal fascia. Fox thinks that symptoms should recur in less than 10%.

The more recent reports particularly give no figures at all or state only percentages of wounds in which primary healing has occurred, or comparative healing times with different methods. Figures for recurrences following healing are rarely given, and yet it is known that these may occur up to 5 years or more and from two to ten times (36,47). In Kooistra's series 1/3 of recurrences appeared in the first month, and 2/3 had appeared within a year. An inkling that recurrences are still

common may be gained from observing that from 12% [44]

to 34% [85] of cases operated on in various recently

reported series, have previously had excision of their

lesions at least once - the average is roughly 20%, to

80% "fresh" cases.

Until accurate figures are available we must

therefore assume that the percentage of recurrence for

wounds primarily closed has remained unchanged.

Kooistra's series published in 1942 is the most

recent adequately reported work. He was able to follow

89 cases of 202 treated in the Hospital of the Univer-

sity of Michigan, after 5 years or more. 74% could be

classed as permanent cures, following all methods of

treatment, which is generally accepted as about the aver-

age expectation [45,93]. 36 of these had been packed

open and 78% cured; 53 had been closed at operation and

72% cured. Healing of wounds had occurred in an average

of 27 days with closure, 84 days when packed open. Aver-

age time away from work was 11 days for those packed,

5½ days for those closed.

Breidenbach and Wilson reported a similar series

of 83 cases in 1935 - "follow-ups" from 288 cases treated.

Of 56 cases packed open or partially sutured 83% were

cured, and of 27 cases closed at operation 59% were cured;

giving an average of 73% cures for all methods. They do

not mention healing times but state that the patient should

be told to expect dressings to be necessary for from 6 weeks

to 3 months.

Healing times reported for open wounds vary from 26.5 days [85] to 3 months [60] in the average case, but occasionally may take 16 months or longer [47].

Rogers analysed 119 cases operated on at the Massachusetts General Hospital before introduction of his special procedure, and found the average stay in hospital 10.9 days, average time off work 8.7 weeks, average healing time 2.7 months. Of those cured only 61% were free of symptoms after 1 to 8 years, the usual symptoms being tenderness, and aching, numbness, irritation or occasional sharp pains in the scar. Of recurrences which were operated on failures occurred 100% in those primarily closed, 58% when packed open. He states that some cases which had a recurrence traced up to a year or more subsequently became healed without further treatment (all but 1 in a group of 8).

Kleckner's data collected in 1936 from different surgeons is of interest. Of 4699 patients operated on for pilonidal disease 4231 had the wound packed open with a recurrence rate of 1.3%, 365 had the wounds closed at operation with a recurrence rate of 23.29%, and 103 additional wounds had been sutured but later had to be opened because of infection.

Weeks and Young had 3% of primarily closed wounds break down completely and heal by granulation and 40% break down partially; Larkin obtained primary healing in 81% of closed wounds; MacFee states that 53% of wounds closed at

operation "developed abscesses or other complications which greatly prolonged the healing time".

Rogers claims that with his method of excision by electrocautery and packing open, the average healing time is 9 weeks and failures have been reduced to 3%.

Cattell and Stoller report 40 cases closed by their technique or Lahey's, with a recurrence rate of about 33%.

Holman claims only 11% failures with his technique in 46 cases, but these are not long term results.

Brezin claims an average healing time of 13.3 days and "almost perfect" results from $1\frac{1}{2}$ to 6 months following operation with his "U"-flap technique.

Shute, et al state they have obtained healing in an average of 11 days in 59 cases in which musculo-fascial flaps were used, but can give no long term results.

Larkin obtained primary healing in 90.9% of "fresh" cases and 71% of recurrences considered suitable for primary closure.

Ferguson and Mecray claim 100% cures with their ambulant treatment following primary closure, 1/3 healed under 10 days, 1/3 in 2 weeks, and 1/3 just over 3 weeks except for three which required 28, 60, and 84 days respectively.

Theis and Rusher report an average healing time of 26.5 days with their special method of partial closure, but had 2 recurrences, 7 infections, 1 hematoma, and 2

ruptured scars in 37 cases.

Dunphy and Matson have reduced recurrences to 6%
in 33 cases of primary closure with non-absorbable suture
material (silk) in the deep layers.

Buie claims no recurrences following marsupiali-
sation in "fresh" cases, and the usual and average length
of time from operation to complete healing is 30 days.

Fig. 16. - Result obtained 14 days following
a modified Colp type of operation on the
same patient shown in fig. 1, p.25. This
patient is now cured at 6 months post-op.

That delineation of the sinus tracts with methy-
lene blue or other dyes makes very little or no difference

to ultimate results is shown by Kooistra, who reports 32%
failures in cases in which it was used and 38% in those
in which it was not. Breidenbach and Wilson state that
in their series the use of delineating agents had not re-
duced the incidence of recurrences - they had 29% using
methylene blue and 32% not using it.

PROGNOSIS

In spite of the rather disappointing picture pre-
sented by results as quoted above, one receives a definite
impression of gradually improving results with the passage
of time in reviewing the literature, especially in the case
of primary closure. This is attributed to the introduction
of sulfonamides and penicillin, universal recognition of
the difficulty of treatment of these cases and correspond-
ing amount of painstaking care expended on them, and pro-
bably least of all to improvements in operative techniques.

The untreated case will in all likelihood continue
to have chronic symptoms with periodic attacks of acute in-
fection for an indefinite period [53]. But on the basis of
results as reported we still must say to the average patient
with a pilonidal sinus that under treatment he will have a
75% chance of being permanently cured by his first operation,
and if cured he will average perhaps 2 weeks in hospital
and 3 weeks off work, and will require dressings for about
2 months. Even if permanently cured he will have approximately

a 40% chance of his scar being tender or painful or other-
wise troublesome. If he falls into the unfortunate 25%
his wound may break down shortly after operation or heal-
ing may be delayed for a year or longer, or he may develop
a recurrence up to 5 years or longer after operation. If
he develops a recurrence it may heal spontaneously after
a varying length of time, or may require re-operation from
one to ten times.

The prognosis with respect to the unusual types of
cases - those with large defects following excision of
lesion or recurrence, those with extensive secondary sinus
formation, and those with lesions at higher levels pro-
bably communicating with the spinal canal, will of course
be more grave and will depend on the individual case. No
deaths have been reported from pilonidal disease directly
or indirectly, except from the development of staphylococcus
meningitis secondary to communication with the subarachnoid
space. No case of malignant change occurring in a pilo-
nidal lesion has been reported.

ANALYSIS OF CASES

From the beginning of January 1943 through October 1946, 107 patients were admitted to Deer Lodge Hospital, Winnipeg, with a diagnosis of pilonidal disease. Records were available in the District for analysis in 73 of these.

Following analysis of case records questionnaires were sent to each of the 73 in order to assess final results, as well as to confirm case record information with regard to age of onset of symptoms, surgical treatment if any prior to admission to this hospital, dates of complete healing and ability to return to work, and the factors of trauma and heredity.

Questionnaires were returned by 53 ex-patients, covering 66 operations, of which 3 consisted of incision and drainage only. 2 of these had been advised to return for excision at a later date but had failed to do so - the third had a later excision and is included in the series. 2 of the remainder had acute abscesses unroofed and curetted and packed with subsequent healing, and will be considered as cases of excision with "open packing".

Of the 51 who had definitive surgery 8 required two operations, and 1 required five before being cured. Each of the 63 operations will be considered as a separate case in assessing results, and on this basis 18 were "recurrences" having been previously excised here or elsewhere, while the remaining 45 were "fresh cases".

Operations were performed by various members of the
attending surgical staff with varying techniques, and no at-
tempt has been made to record results separately for each
minor variation. In the very great majority a block of tis-
sue containing the lesion was excised by a vertical 'double
elliptical' incision deepened as necessary and with lateral
extensions where necessary to include multiple sinuses. The
resulting wound was then packed open to heal by granulation,
closed by a modification of the Colp or Lahey techniques, or
partially closed. In a few cases secondary suture of the
median wound or of relieving incisions in one or both but-
tocks was carried out.

Criteria of cure: All patients at the time of completing
                        the questionnaire had had their last
operation from five to forty-six months previously, as in-
dicated in the accompanying diagram (Fig. 17), had no recur-
rence of discharge, and had no more than the most superfi-
cial occasional breaking down of a solid well-healed scar.

Symptoms: In order of frequency these were as follows:
        Soreness on sitting down
        Chronic discharge
        Soreness on stooping over
        Tender lump
        A series of abscesses
        A single abscess
        Painful or tender scar

7 of the 53 stated that they had known of the presence of their pilonidal lesion before symptoms developed.

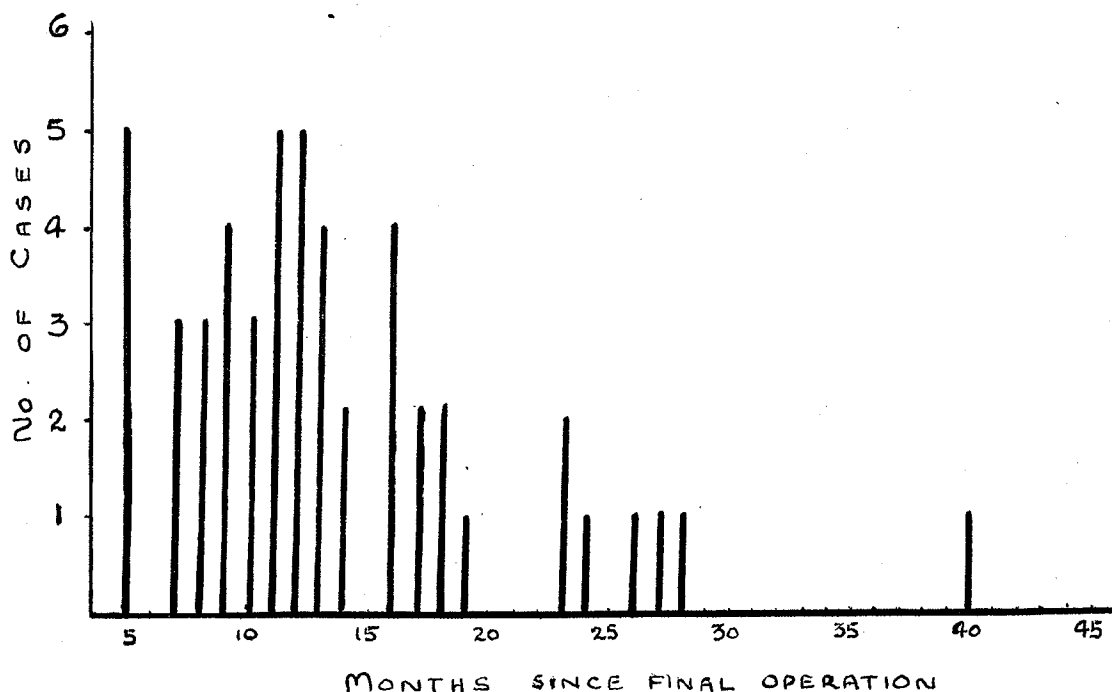Fig. 17. - Illustrating periods of time from final operation to completing of questionnaire.

Influence of trauma: 26 of the 53 answering the question-
                        naire, or 49%, definitely related
the onset of their symptoms to trauma. 12 or 22.6% gave a
history of a severe or fairly severe injury to the sacro-
coccygeal region within a month of the appearance of symp-
toms, and 14 or 26.4% described an injury or injuries fur-
ther removed in time up to a year.

Influence of heredity: 1 of the 53 stated that he has a
                          sister with a pilonidal sinus, and
1 a daughter aged seven months and a small nephew "with the same

condition". All others knew of no relations who had pilo-
nidal disease.

Sex incidence: 6 female patients were found among the 73
                  whose records were available, an inci-
dence of 8.2%. This is much lower than the reported aver-
age, which would be expected in an institution devoted to
the care of war veterans.

Age incidence: The average age at first admission of the
                  cases analysed was 25.4 years, and age at
onset of symptoms 17.6 years. The number of patients in
each age group is indicated in the accompanying diagram (Fig.
18). Though these figures conform to the average of those
reported, they lose much in significance by the fact that
they originate from a veterans' hospital where the average
age of all admissions is fairly low.
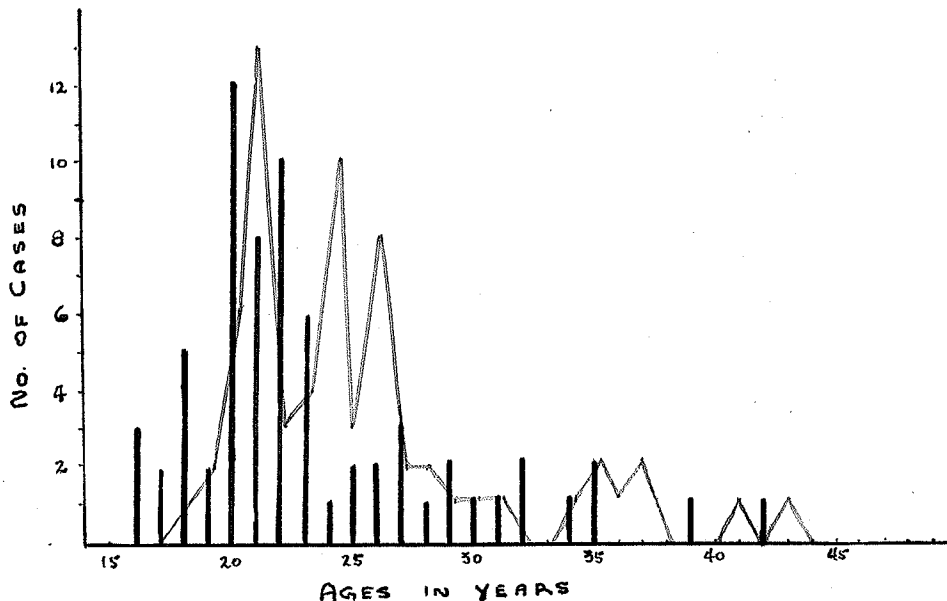

Fig. 18. - Ages at onset of symptoms (with ages at time
of first admission in red).

Total incidence: The 107 admissions for treatment of
                     pilonidal disease are included in a
total of admissions to the hospital for the same period,
of 31,843, giving an incidence of just over 1:300.

Associated congenital lesions: No other congenital ab-
                                   normalities were noted
in any of the 73 case records available except in one
where radiography showed sacralisation of the fifth lumbar
vertebra and spina bifida occulta involving the first,
third, fourth and fifth sacral segments with irregularity
of outline of the segments of the coccyx. Radiographs of
the region were taken however in not more than half the
cases.

Types of lesion: In 7 of the 73 cases or approximately
                     10% a cyst alone was found, with no
sinus associated. All of the ordinary types comprised the
other 90%, with one or several lateral secondary sinuses
in sacro-coccygeal area, buttock or perinaeum in some cases.
None of the lesions was found at a higher level.

Results of operations: A table is appended (Fig. 19) to
                           indicate results obtained from
the major types of operative procedure carried out. Broadly
these are classified as wounds closed, wounds packed ppen,
and wounds partially closed. The former is subdivided into
those closed by primary suture, and those in which some type
of secondary suture was done, either of the central wound or

Type of operation	Number of cases	Average post-op hospital days	Average days nec. for healing	Average days off work	Number of failures	Percent failures
Primary closure	42	24.1	16.1	46.8	11	26.2
Secondary suture	4	43	54.5	84.2	0	0
Subtotal closed wounds	46	25.8	19.7	50.5	11	23.9
Packed open	15	50.3	73.8	89.4	2	13.3
Partially closed	2	72	x	x	1	50

Total cases 63   Total failures 14, or 22.2%

Fig. 19. - Results classified as to type of operation.

(x - It is noted that in 5 wounds primarily closed, 2 packed open and 1 partially closed further surgery was undertaken before healing had occurred, and therefore they are not included in computing averages for healing times and days off work, the averages in each case referring to the remaining cases in the group.)

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of lateral relieving incisions.

Of the 14 failures, 7 were cured by their second
operation and 1 by his fifth. 1 was not cured by either
of two operations in this series, and 1 had no second op-
eration included within the period of this review.

The 49 cured have been classified on the basis of
their answers to the questionnaire into those who are
satisfied with their result and those who are not. Each
of these groups may be further subdivided - the former
into those who are completely satisfied and those who
mildly qualify their satisfaction by reference to slight
occasional tenderness, itching, irritation or soreness in
the scar; the latter into those who complain of moderate
to severe symptoms referred to the area such as pain,
aching, numbness, coldness, tightness, and those in whom
an occasional superficial breaking down of the scar is
added to one or more of the above. 41 or 83.7% are sat-
isfied with the result, and 8 or 16.3% dissatisfied. These
results have been tabulated with respect to type of op-
eration used (Fig. 20). The psychological background en-
gendered in some cases by possible pension considerations
may have a slight bearing on interpretation of these re-
sults.

In this series therefore packing the excision
wound open resulted in a comparatively low percentage of
failures but only 70% of those cured were satisfied with
the result after an average of almost two months in hos-

Type of procedure	Number of patients	Satisfaction with result		Percent	Dissatisfaction Pain, cold-ness, &c.	Breaking down of scar	Percent
		Complete	Qualified				
Wound closed	35	21	10	88.6	3	1	11.4
Packed open	13	5	4	69.2	3	1	30.8
Partially closed	1	1	0	100	0	0	0
Totals	49	27	14	83.7	6	2	16.3

Fig. 20. - Final subjective results from different types of procedure.

pital and loss of time from work of almost three months during the greater part of which continued dressing of the wound was necessary. In those who had the wound closed healing occurred in an average of less than 20 days, less than a month was spent in hospital and less than two months away from work, and 90% of those cured were satisfied with the result, but the percentage of failures was almost doubled.

Delineating agents: It is interesting to note that no dye was used to outline the sinus tracts in any of the cases which resulted in failure. However, dye was used in only 10 of the 63 operations, in each case methylene blue or a mixture of methylene blue and melted paraffin.

CONCLUSIONS

1. Pilonidal disease is important to the surgeon chiefly because of the difficulty encountered in its effective management.

2. The origin of these congenital lesions is not known after 100 years of controversy. That they are due to abnormal persistence of ectodermal invaginations occurring in the embryo seems most likely.

3. Symptomatic lesions are four times more common in males; symptoms almost always appear between 18 and 25 years of age, the average being somewhat earlier in the female.

4. Average incidence is roughly 1:1000 hospital
admissions, but it is considerably more prominent in mem-
bers of modern armed forces.

5. Trauma would seem to play a very definite role
in the onset of symptoms. This is probably the chief rea-
son for the apparent recent increase in frequency coinci-
dent with the war and first post-war years.

6. Peculiarities in the anatomy of the region of
the natal cleft are responsible for much of the difficulty
in treatment and poor results obtained.

7. Meticulous attention to detail in pre- and
post-operative care as well as at operation is extremely
important.

8. Complete surgical excision of the lesion after
subsidence of inflammation is the only treatment of value.

9. "Recurrences" are in the great majority of cases
due to infected dead space either left at operation or
occurring as a result of slight or severe trauma during the
healing process. Great care in guarding against trauma,
and maintenance of correct posture, are very important for
at least a month following operation.

10. Results are gradually improving, probably due
to the availability of penicillin chiefly, but still leave
much to be desired, and pilonidal sinus must be classed as
a serious disease.

11. Primary closure following excision of the
lesion is favored in the great majority, if circumstances

allow 2 to 3 weeks in hospital and a month of convalescence, because of shorter healing time, fewer dressings required, and the greater chance of a satisfactory end result. If circumstances are less favorable primary closure - by a buttock rotation flap if necessary - would be abandoned under protest, and carried out if at all possible.

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BIBLIOGRAPHY

1. Hodges, R. M., Boston Med. and Surg. Jour., 103:485, 493, 544, 1880.

2. Anderson, A. W., Boston Med. and Surg. Jour., 36:74, 1847.

3. Warren, J. M., Surgical Observations with Cases and Operations, pp. 192-3, Boston: Ticknor and Fields, 1867.

4. Vaughan: 1865. (quoted by Mallory).

5. Mason: 1880. (quoted by Stone).

6. Weeder, S. D., Ann. Surg., 98:385, 1933.

7.   Quain: Anatomy, (quoted by Mallory).

8.   Jordan and Kindred, Textbook of Embryology, 4th. ed.,
          p. 48, D. Appleton - Century, 1942.

9.   Hamilton, Boyd, and Mossman, Human Embryology,
          W. Heffer and Sons Ltd., Cambridge, 1945.

10. Gross: System of Surgery, (quoted by Mallory).

11. Lamadrid, J. J., Philadelphia Medical Times, 3:699, 1873.

12. Walker: 1875. (quoted by Mallory).

13. Fère: 1878. (quoted by Breidenbach and Wilson).

14. Heurtaux: 1882. (quoted by Mallory).

15. Terrillon: 1882. (quoted by Breidenbach and Wilson).

16. Kuhn: (quoted by Stone).

17. Tait, Lawson: 1892. (quoted by Mallory).

18. Lannelongue: 1889. (quoted by Mallory).

19. Couraud: 1883. (quoted by Stone).

20. Wendelstadt, H: 1885. (quoted by Stone).

21. Masse: 1887. (quoted by Mallory).

22. Bland-Sutton, J., J. Anat. & Physiol., 20:432, 1886.

23. Aschoff, Ludwig: 1895. (quoted by Breidenbach and
          Wilson).

24. Tourneux, F., and Hermann, G., 1887. (quoted by
          Mallory, and Fox).

25. Mallory, F. B., Am. J. M. Sc., 103:263, 1892.

26. Stolper: 1899. (quoted by Markoe and Schley).

27. Stone, H. B., Ann. Surg., 79:410, 1924.

28. Streeter, G. L., (quoted by Stone).

29. Stone, H. B., Ann. Surg., 94:317, 1931.

30. Bookman, M. R., (quoted by Cattell and Stoller).

31. Oehlecker, F., (quoted by Cattell and Stoller).

32. Weinstein, M., Ann. Surg., 97:80, 1933.

33. Newell, R. L., Brit. J. Surg., 21:219, 1933.

34. Fox, S. L., Surg., Gynec. & Obst., 60:137, 1935.

35. Gage, M., Arch. Surg., 31:175, 1935.

36. Kooistra, H. P., Am. J. Surg., 55:3, 1942.

37. Kallet, H. S., (quoted by Shute, et al).

38. Mummery, P.L., (quoted by Anderson, J. K.).

39. Granet, E., and Ferguson, L. K., Am. J. Surg., 70:139,
         1945.

40. Ripley, W., and Thompson, D. C., Am. J. Dis., Child.,
         36:785, 1928.

41. Moise, T. S., Surg., Gynec. & Obst., 42:394, 1926.

42. Ferguson, L. K., and Mecray, P. M.,Jr., Am. J. Surg.,
         36:270, 1937.

43. Breidenbach, L., and Wilson, H. L., Ann. Surg., 102:455,
         1935.

44. Smiley, K. E., Am. J. Surg., 27:298, 1935.

45. Bernstein, W., Staff Meeting Bulletin, Hospitals of
         the University of Minnesota, 18:53, Oct.18, 1946.

46. Lane, W. Z., (quoted by Bernstein).

47. Holman, E., Surg., Gynec. & Obst., 83:94, 1946.

48. Dulligan, P. J., Am. J. Surg., 6:554, 1929.

49. Weeks, R. B., and Young, G. G., Am. J. Surg., 60:260,
         1943.

50. Winkler, J., (quoted by Breidenbach and Wilson).

51. Despres, A: 1874. (quoted by Breidenbach and Wilson).

52. Markoe, F. H., and Schley, W. S., Am. J. M. Sc.,
         123:820, 1902.

53. Ravdin, I. S., and Johnston, C. G., Am. J. M. Sc.,
         190:280, 1935.

54. Brockbank, M. J., and Floyd, J. R., Am. J. Surg.,
         68:77, 1945.

55. Buie, L. A., South. M. J., 37:103, 1944.

56. Scott, J. V., Ann. Surg., 117:191, 1943.

57. Glenn, F., (quoted by Ferguson and Mecray).

58. Ottenheimer, E. J., Am. J. Surg., 21:120, 1933.

59. Bartlett, W., Surg., Gynec. & Obst., 80:69, 1945.

60. Rogers, H., New England J. Med., 222:79, 1940.

61. Brezin, D., et al., Am. J. Surg., 60:264, 1943.

62. Williams, H. T. (personal communication).

63. Brams, J., Radiology, 8:248, 1927.

64. Sharpe, A. M., Am. J. Roentgenol., 38:303, 1937.

65. Gray, H., Anatomy, Descriptive and Applied., 24th. ed.,
        p. 468, Longmans Green & Co., 1930.

66. Beall, E. J., Tr. South. Surg. & Gynec. Soc., 1888,
        (Birmingham, Ala.) 1:79, 1889.

67. Camp, M. N., and Polites, N., Am. J. Surg., 59:541,
        1943.

68. Colp, R., S. Clin. North America, 9:695, 1929.

69. Anderson, J. K., Minnesota Med., 14:421, 1931.

70. Biegeleisen, H. I., Am. J. Surg., 44:622, 1939.

71. Cutler, E. C., and Zollinger, R., Am. J. Surg., 19:411,
        1933.

72. Crookall, A., (quoted by Anderson, J. K.).

73. Maillard, E. R., J.A.M.A., 93:1383, 1929.

74. Stanton, F. D., (quoted by Shute, et al., and Christopher).

75. Smith, R. M., Am. J. Roentgenol., 38:308, 1937.

76. Shute, F. C.,Jr., Smith, T. E., Levine, Max, and Burch,
        J. C., Ann. Surg., 118:706, 1943.

77. Blaisdell, P. C., J. A. M. A., 133:916, 1947.

78. Babcock, W. W., S. Clin. North America, 6:42, 1926.

79. Kleckner, M. S., (quoted by Scott, and Buie).

80. Rosser, C., and Kerr, J. G., J. A. M. A., 133:1003, 1947.

81. Rogers, H., Surg., Gynec. & Obst., 57:803, 1933.

82. Scarborough, A., (quoted by Rosser and Kerr).

83. Lahey, F. H., Surg., Gynec. & Obst., 48:109, 1929.

84. Cattell, R. B., and Stoller, L. W., New England J. Med., 206:110, 1932.

85. Larkin, L. C., Surg., Gynec. & Obst., 82:694, 1946.

86. LaRochelle, F. D., (quoted by Rogers).

87. Morter, C. W., (quoted by Rogers).

88. MacFee, W. F., Ann. Surg., 116:687, 1942.

89. Theis, F. V., and Rusher, M. W., Surg., Gynec. & Obst., 79:482, 1944.

90. Merkeley, N. P. (personal communication).

91. Graham, H. F. (quoted in Discussion after paper of Shute, et al.).

92. Dunphy, J. E., and Matson, D. D., Surg., Gynec. & Obst., 75:737, 1942.

93. Christopher, F., Minor Surgery, 3rd. ed., p. 415, W. B. Saunders Co., 1938.

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