THE SURGICAL PATHOLOGY OF EPIDIDYMITIS

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Although epididymitis is predominantly of gonococcus etiology, other bacteria may produce lesions clinically indistinguishable either from those of gonorrhœal origin or from those due to the tubercle bacillus. We found in a recent study of 3606 cases of epididymitis admitted to the Urological Service of Bellevue Hospital that while 3000 of this number resulted from Neisserian infection, the remainder were etiologically divided between those of tuberculosis (280) and those commonly designated as "non-specific" in origin (326). We are not concerned here with the tuberculous variety. "Non-specific" we more properly designate as non-gonorrhœal non-tuberculous since staphylococci, streptococci, colon bacilli, Friedlander bacilli and more rarely micrococci catarrhalis may be etiologically identified with the epididymitis, either individually or in combination.

Demonstration of the gonococcus in the discharge of an associated urethritis confirms the diagnosis of gonorrhœal epididymitis. Often no discharge is present which may mean (1) there is a latent gonococcus infection of the posterior urethra and adnexa (prostate and seminal vesicles) or (2) the epididymitis is non-gonorrhœal in origin. Urethral discharge may, however, contain some of the pyogenic bacteria above mentioned and no gonococci. This finding usually indicates the etiology of the lesion.

The diagnosis having been made, the patient is at once put to bed, given a cathartic, and the adhesive plaster scrotal suspensory dressing described elsewhere is applied.[1] Complete immobilization and high elevation of the scrotal contents is attained by this dressing; its equal cannot be purchased in shops. As a rule an ice cap is applied to the inflamed parts although in some cases greater relief is afforded by heat. Pain will be relieved at once in many and within twelve hours in two-thirds of these cases.[1] Those not able to sleep the second night after institution of this treatment are operated upon. For some time a persistent elevation of the temperature was our operative criterion, but we have found the persistence of pain is a more reliable surgical guide. One in fifteen of the gonorrhœal and one in four of the non-gonorrhœal non-tuberculous cases required operation. Epididymotomy is the procedure of choice, although occasionally epididymectomy and more rarely orchidectomy must be performed.

Surgical treatment of epididymitis by puncture was first employed by Velpeau.[2] Plunging a needle through the skin, multiple punctures were made in the underlying indurated mass. Immediate relief was obtained in most cases; the surgical complications of hemorrhage and infection are not

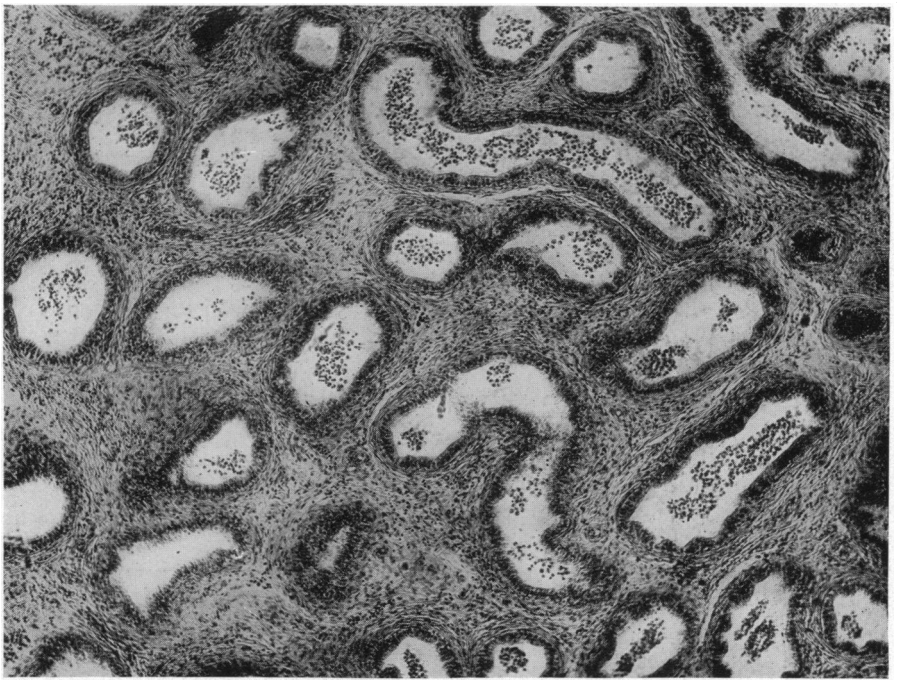

FIG. 1.—Beginning intratubular leucocytic exudation. At this stage there is but moderate cloudy swelling without loss of normal structures. Exudate is chiefly polymorphonuclear. Early interstitial infiltration is noteworthy.

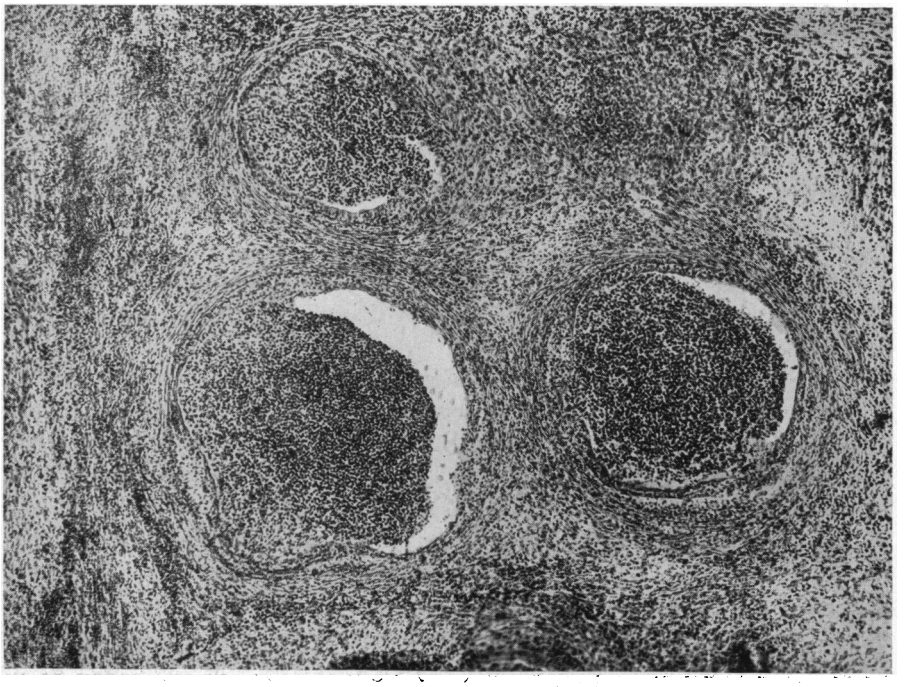

FIG. 2.—Tubular filling with rupture of basement membranes and extension into interstitial tissues. Intensification of leucocytic stroma infiltration.

recorded. Velpeau's work was subsequently warmly endorsed by de Cassis and others. Open epididymotomy, however, was first performed by Pirogoff [3] in 1852. Twelve years later and unaware of Pirogoff's work, Smith [4] recorded

TABLE I.

Age	Gc.	Non Gc.	Total
19 and under	8	1	9
20–29	159	25	184
30–39	33	25	58
40–49	5	17	22
50–59	2	8	10
60 and over	1	1	2
Not recorded	1	2	3
			288

TABLE II.

Side Involved	Gc.	Non Gc.	Total
Right	104	38	142
Left	79	35	114
Bilateral	26	6	32
			288

twenty cases of acute epididymitis in which the agonizing symptoms were at once relieved by exposure of the epididymis and multiple incisions into its substance with a sharp knife, "being careful not to incise the testicular substance." Since Smith's paper several surgeons have reported numerous epididymotomies, but it remained for Hagner [5] (1906) to demonstrate a safe and simple technic which may be unhesitatingly and universally employed. The Hagner method of epididymotomy is the routine procedure in the Bellevue Hospital Urological Clinic. Epididymectomy is performed for (1) gross destruction of the epididymis and (2) recurrence of epididymitis after epididymotomy or (3) in some cases after repeated attacks without operation. Diffusely cystic and some otherwise grossly diseased epididymes have at times been removed.

Of 3326 cases of non-tuberculous epididymitis studied by us, 209 of the gonorrhœal and seventy-nine of the non-gonorrhœal cases were operated upon. Epididymotomy was performed a total of 200 times. Epididymectomy primary or secondary was the procedure in seventy-four, and orchidectomy for abscess in thirty-five cases (Table III), a total of 309 operative procedures on 288 patients. Sometimes the epididymis and testicle were removed en masse. From these operations seventy-six surgical specimens have been available for study and constitute the basis for our discussion of the histopathology.

All chronically inflamed and most subacutely inflamed epididymes may be removed under local anæsthesia (fifty-eight times). Manipulation of the

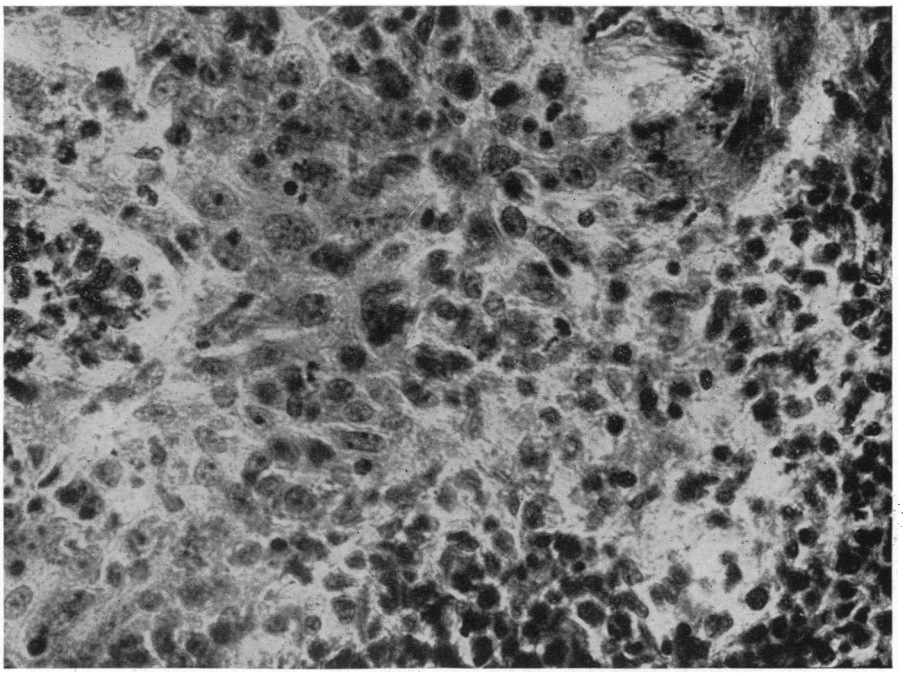

FIG. 3.—Character of early cellular exudate in wall of a tubule. Of particular interest are the numerous plasma cells and large mononuclears.

FIG. 4.—Later stage of Fig. 2. The location of former tubules is suggested by lighter areas in suppurative mass.

TABLE III.

Type of Operation	Gc.	Non Gc.	Total
Epididymotomy	178	22	200
Epididymectomy:			
Primary	24	45	69
Secondary to Epididymotomy	3	2	5
Orchidectomy			
Primary	5	16	21
After:			
Epididymotomy	5	7	12
Epididymectomy	1	1	2

acutely involved organ is often painful even after novocain infiltration, and in this group the administration of a general anæsthesia has been our procedure of choice (170 times). In seven cases spinal anæsthesia was used with entire success and in the hands of one skilled in its use, is the ideal anæsthesia.

The scrotum about to be incised is tense and shiny if the process is acute. Certain areas with underlying gross abscess may be glazen in appearance. Scrotal œdema adds greatly to the size of the inflammatory mass. If the lesion is subacute or chronic, integumentary changes may be absent or those of mild injection and œdema.

Usually the tunica vaginalis is thickened, indurated and when incised releases a variable quantity of hydrocele fluid, the formation of which results from inflammatory irritation of the serous membrane. Exudation was recorded as present in 101 of the operated cases. Clear or cloudy fluid was noted to be present in sixty-eight, the quantity varying from 5 c.c. to four ounces. When the process is acute, fibrin is usually found. We observed it in amounts of one dram to three ounces twelve times. Occasionally organized fibrin will add great palpable solidity to the mass, and was found in four instances. Serosanguineous fluid is occasionally encountered, as is free pus. (Table IV.) If the lesion has been present for some days or if there

TABLE IV.

Hydrocele Present	Gc.+	Gc.—	Total
Fluid 1 dram to 8 ounces	53	15	68
Fibrin 1 dram to 3 ounces	8	4	12
Fibrin (organized) ½ oz. to 1½ oz.	4	..	4
Serosanguineous fluid	4	2	6
Free pus in tunica vaginalis	6	5	11
			101

has been antecedent inflammation, adhesions may firmly bind the tunica vaginalis to the epididymis and testicle or may tenaciously unite the testicle and epididymis in a solid mass. Furthermore, if the epididymitis is a recurrent

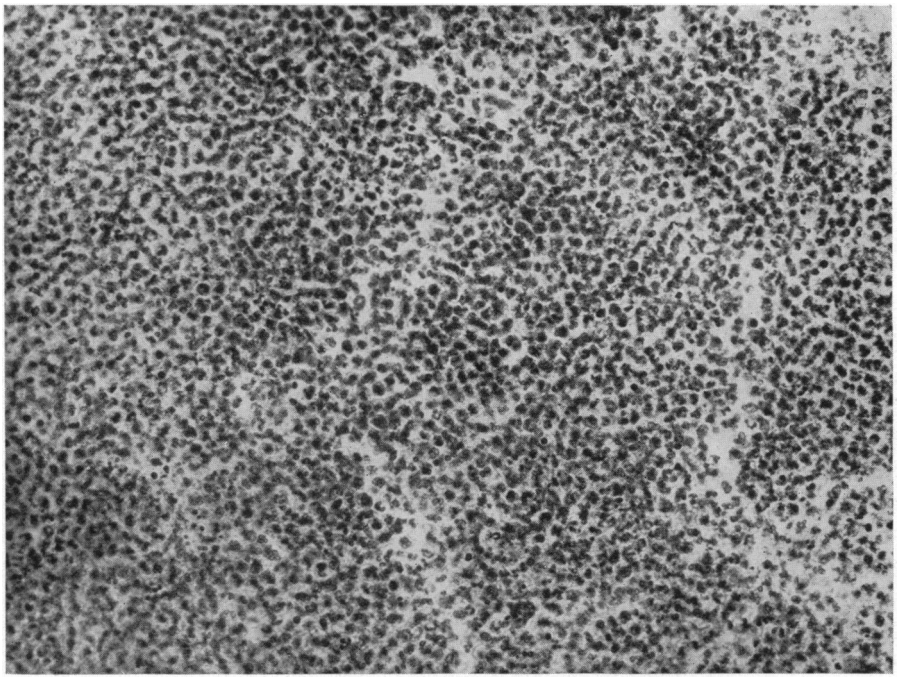

FIG. 5.—Massive necrosis of epididymis. No landmarks. A later stage of Fig. 4.

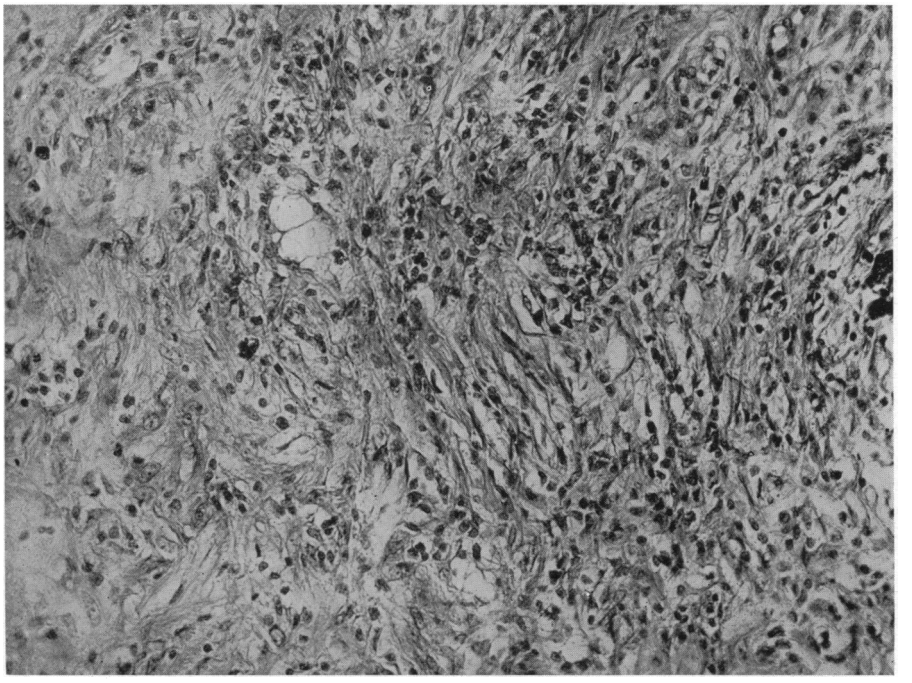

FIG. 6.—Œdematous infiltration of stroma of epididymis with vacuolization.

attack, cystic degeneration of the organ is frequently observed. While probably of greater incidence, cystic changes were noted five times in this series. Inflammation of the tunica vaginalis is proportional to the severity of the attack. The membrane may be either velvety-red or pallid. Coexisting injection of the tunica albuginea may be observed, but the testicle is not involved except secondarily by (1) extension of an epididymis abscess or (2) by thrombosis of the lower spermatic cord with trophic gangrenous orchitis.

The anatomical progression of the infection from the posterior urethra, prostate, and seminal vesicles down the vas deferens explains the greater incidence and increased severity of globus minor involvement. That transmission of infection is unquestionably by the vas and its mural lymphatics has been clinically demonstrated by vasectomy. Prior to 1925, 30 per cent. of our prostatics at Bellevue developed acute epididymitis at some stage of their hospitalization, usually post-operatively. Two years ago routine vasectomy (ligation with resection of 1 cm. of vas) was instituted, and since then this type of epididymitis has occurred but twice. Metastatic pyogenic blood borne infection of the epididymis has been observed but is rare. We have seen it associated with influenza, pneumonia, and acute tonsillitis each in one case.

Gross examination and incision of the exposed epididymis clearly indicates that the lesion is nearly always most acute in the globus minor. It may be limited to this part, but extension to the globus major or head usually occurs with the formation of numerous punctate abscesses. Frequently by coalescence of these abscesses the entire organ is converted into a suppurating mass and by extension, secondary destruction of the testicle may ensue. (Table V.)

TABLE V.

Gross Surgical Pathology.

	Abscess			Inflammation					
				Acute			Chronic		
	GC.+	GC.−	Total	GC.+	GC.−	Total	GC.+	GC.−	Total
Epididymis :									
Head	26	5	31	21	1	22	..	..	..
Body	12	4	16	1	1	2	..	..	..
Tail	41	12	53	8	11	19	..	1	1
Universal	23	8	31	67	27	94	..	2	2
Cord	..	1	..	..	..	..	..	..	..
Vas	3	1	4	2	..	2	..	..	..
Testicle	4	8	12	..	..	..	..	..	..
Present (location Not recorded)..	90	..	..	105	..	..	..	..	..

It is to be noted, moreover, that gross suppuration requiring surgical liberation is observed four times more frequently in the non-gonorrhœal than in the gonorrhœal cases, and the incidence of secondary suppurative orchitis is

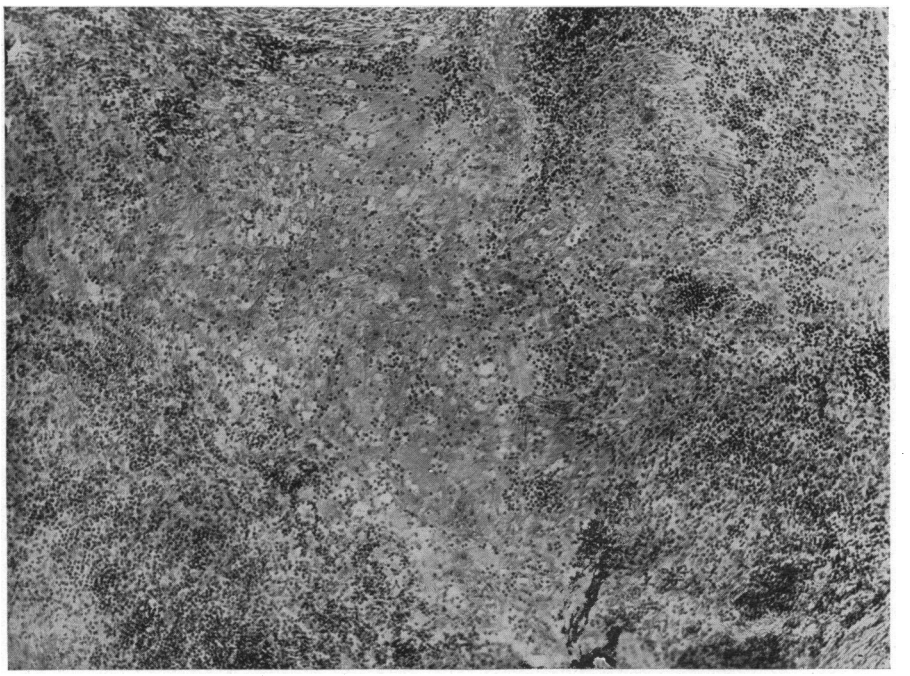

FIG. 7.—Hyalin degeneration with vacuolization. Generalized leucocytic infiltration.

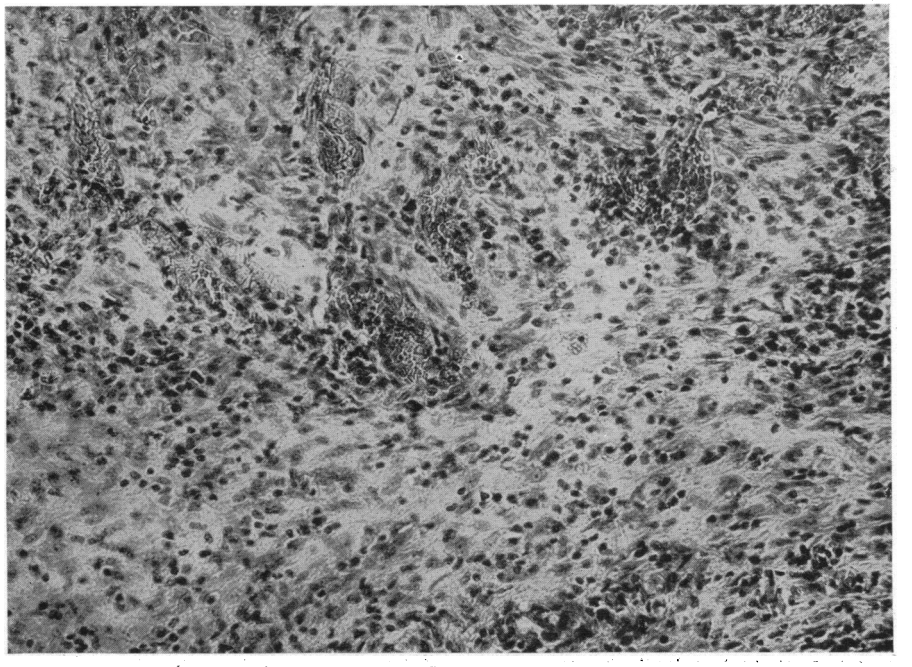

FIG. 8.—Repair process. Particularly about the margins of necrotic areas do innumerable capillary sprouts of young connective tissue push their way into the resolving debris.

proportionately higher. On the other hand, a surprising number of epididymes shows only moderate inflammatory involvement with great pain and without gross pus. Examination of the serosanguineous fluid obtained on puncture of these organs reveals myriads of leucocytes and indicates a mild degree of suppuration, a constant histological finding in early acute lesions.

The pathological histology of gonococcus and non-gonorrhœal non-tuberculous epididymitis is identical with this exception—resolution is somewhat slower in the gonococcal variety. In each type, however, a definite inflammatory cycle is observed, the changes noted histologically as well as grossly depending on the virulence of the attack and to a lesser degree on the tissue resistance of the host and the treatment employed. These inflammatory processes we broadly classify as acute and chronic. The primary phase of the acute inflammation is exudative or catarrhal; the second phase is suppurative or necrotic. Chronic inflammations are suppurative or, if the repair process is well under way, proliferative. It must be borne in mind that an inflamed organ may show microscopically several stages of inflammation, exudation or necrosis in some parts with repair and sclerosis elsewhere. On the other hand, in each specimen there is usually a predominant process, and the various epididymes studied by us have been classified according to this prevalent inflammatory picture. (Table VI.) It is interesting to note the increased

TABLE VI.

*Pathologic Histology.**

Specimens available for study Gc.+ 22 Gc.— 54; Total 76			
Acute	Gc.+	Gc.—	Total
Exudative	4	4	8
Suppurative	13	25	38
Chronic			
Suppurative	4	13	17
Proliferative	1	12	13
			76

* Tabulated according to the predominant histological picture. In some tissues, all of the above stages may be recognized, more particularly among those removed from cases of recurrent epididymitis.

incidence of the chronic inflammatory phase in the non-gonorrhœal non-tuberculous group. Unquestionably the absence of venereal infection misleads these patients into a misconception of the severity of their respective lesions and treatment is postponed until prolonged pain and fever is no longer tolerable, or the appearance of signs of gross suppuration, possibly with sinus formation, arrests the attention.

HISTOPATHOLOGY

Of the important histopathological contributions concerning epididymitis perhaps the earliest is that of Scheperlern who, in 1871, first pointed out the destruction of the walls of the ductus epididymis by lymphocytic infiltration with periductal invasion by leucocytes. In 1903, Audry and Dalou described

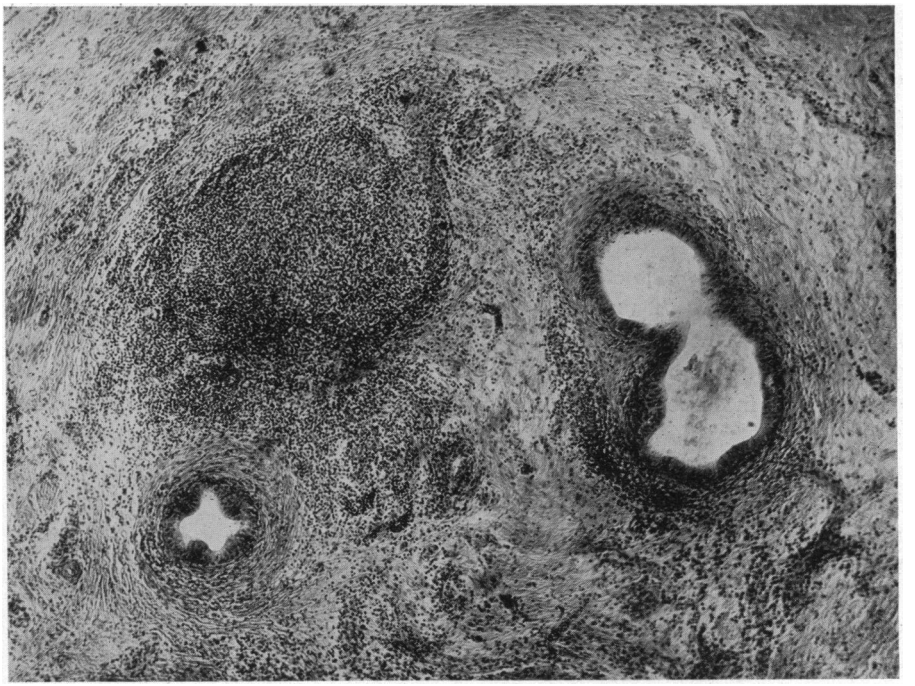

FIG. 9.—Peritubular and interstitial sclerosis with persisting tubular abscess. The ultimate conversion of such an abscess into scar is indicated in Fig. 10.

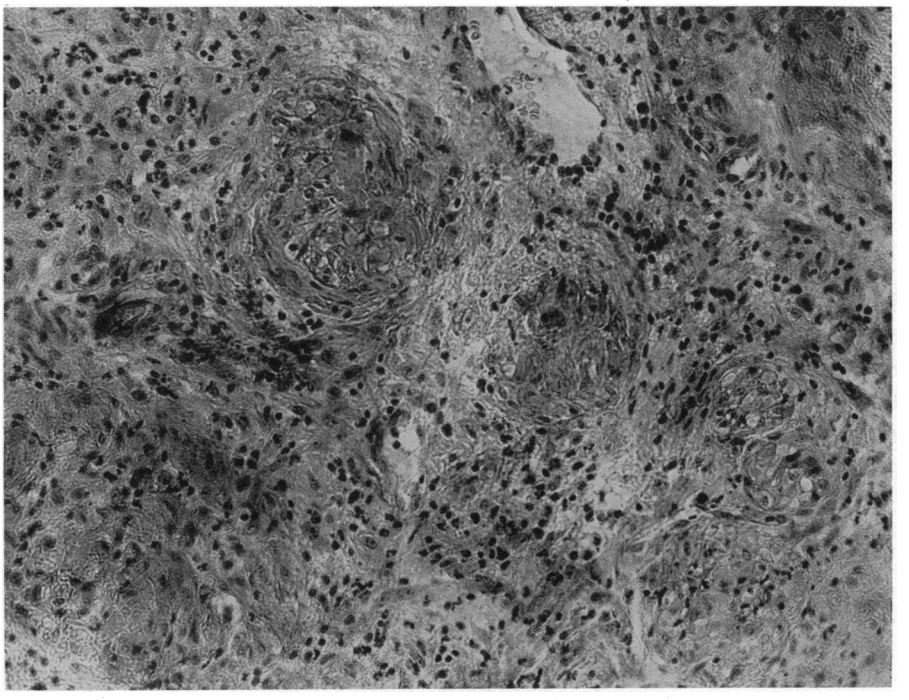

FIG. 10.—Replacement of inflamed tubules by scar. Sclerotic end result of many tubular abscesses. Cause of sterility apparent.

the formation of tubular abscesses, the infectious invasion of the interstitial tissue and lymphatics, and certain phases of tubular repair. Berman (1905) first demonstrated gonococci in acute lesions and since then others have described various tissue changes in both acute and chronic epididymitis.

Acute Epididymitis.—At the onset of the inflammation the process is that pathologically designated as acute catarrhal or exudative. There is cloudy swelling and desquamation of the cylindrical epithelium lining the tubules. This is at once followed by both intratubular and interstitial infiltration with polymorphonuclears, plasma cells, lymphocytes, large mononuclears and a variable degree of œdema. (Fig. 1.) As the inflammation becomes progressively more intense, the leucocytic and œdematous infiltration increases and the underlying vascular changes become pronounced. Enormous acute congestion with massive diapedesis of red blood-cells into the surrounding tissues is seen. While this destructive process is taking place, the phenomenon of vascular repair is well under way and about the periphery of the numerous focal lesions capillary sprouts of young connective tissue push their way into the destroyed tissues. This has been seen within thirty hours after acute onset of the disease.

The transition from the acute catarrhal or exudative stage to that of suppuration is indeed rapid and overlapping; no academic line of demarcation can be drawn. Before the initial process is well begun, microscopic focal abscesses (Fig. 2) are evident in the globus minor, so that within forty-eight hours grossly discernible abscesses may be formed by the confluence of several of the smaller. Hence, the majority of acutely inflamed epididymes removed at operation will present histologically, if not grossly, the picture of massive suppuration with generalized tubular destruction and loss of most of the normal landmarks.

Bringing about this picture of gross destruction are certain minute histological changes. With marked infiltration and engorgement of the tubules with leucocytes, the basement membranes are ruptured early and the mass becomes a focal abscess. Leucocytic infiltration is predominantly polymorphonuclear at first, but in some cases the lymphocytes outnumber these cells. Large mononuclear cells appear early and may be numerous. (Fig. 3.) They are best observed within the lumen of the tubules. Œdema is generalized, most pronounced where the inflammatory battle is most severe and gives rise to the characterisitic picture of tissue vacuolization—the fluid infiltration of the stroma. (Fig. 6.) Fibrin appears first in the periphery and may later show organization. In two-thirds of the specimens from acute cases we observed hyalin degeneration. (Fig. 7.) Eosinophiles are commonly seen in unusual numbers. Kretschmer and Alexander[2] noted an increased cell count of eosinophiles in the blood in some of their patients. We did not observe this alteration in the circulating blood, although the increased presence of these cells locally was often notable.

Chronic Epididymitis.—As the transition from the acute to the chronic stage is a matter of clinical relativity, so, histologically, does the picture of

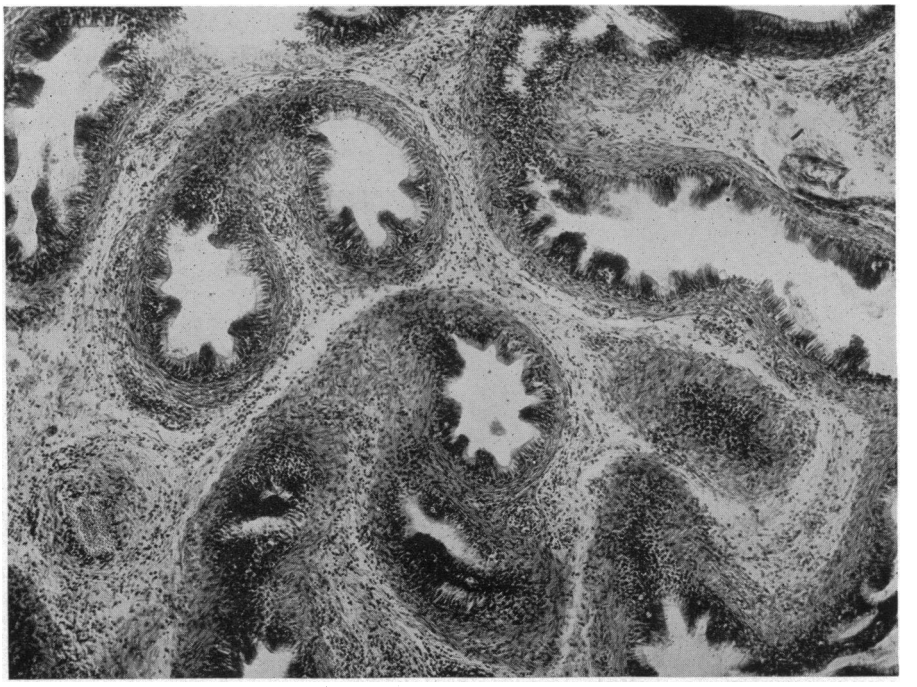

FIG. 11.—If the tubules are not destroyed, by peritubular sclerosis with contraction and by proliferation of the lining epithelium, numerous papillary projections into the lumina are formed. See text.

FIG. 12.—Acute exudative vas deferentitis with occlusion of the duct and marked infiltration of vasal lymphatics.

late acute become that of relatively early chronic epididymitis. As a rule, a type change in the leucocytic infiltration is observed, lymphocytes come to outnumber the polymorphonuclears. Too, there is a marked increase in the large mononuclear phagocytes, another characteristic of the repair process. Although the epididymis may be a mass of resolving areas of necrosis, vas-

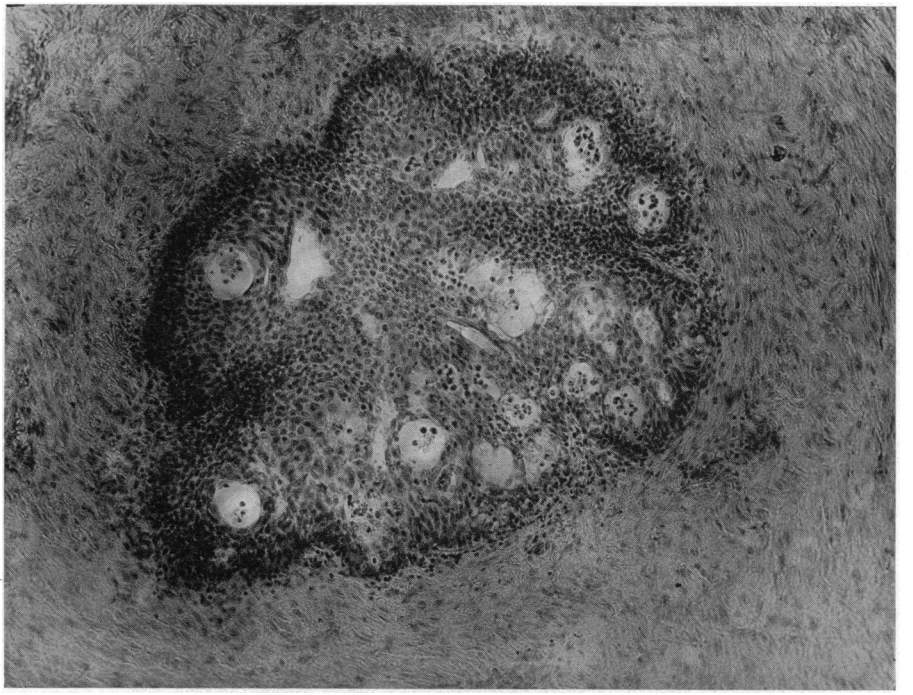

FIG. 13.--End result of condition shown in Fig. 12. Often the vas is completely blocked by scar—perhaps more often partially occluded as shown in this section.

cular and connective tissue repair is everywhere evident, but is most active about the periphery of these abscesses. As new scar is laid down, the massive œdema disappears and by this repair necrotic debris is replaced by connective tissue. Areas showing considerable fibrosis may by compression of the blood-vessels be relatively anemic. While vascular proliferation is universally evident with the formation of myriads of new capillary sprouts (Fig. 8) marked thickening of the walls of the older vessels by infiltration, scarring, or perisclerosis occurs. (Fig. 9.)

This sclerosis constitutes the proliferative or terminal phase of the inflammatory process. With the absorption of the exudate and necrotic tissue and its replacement by scar, the remains of many tubules disappear. (Fig. 10.) Other tubules become permanently occluded by post-inflammatory organization, while still others remaining patent undergo hyperplastic changes which are diagnostically characteristic of this stage of the disease. (Fig. 11.) The normal cylindrical epithelium having been lost by exudation, it is replaced by the squamous type. By irregular overgrowth it produces areas of heaped up

epithelium extending into the lumen of the tubules suggestive of papillomata. Contraction of the tubular walls by intra- and perimural infiltration and sclerosis greatly increases this intratubular intrusion. This squamous cell hyperplasia and sclerotic contraction of the walls may actually occlude the tubules. Bearing in mind this picture of generalized scarring, it is not difficult to understand the presence of residual nodular indurations so often clinically palpable twenty years after the acute attack. Most of these persist for life.

Some of our material was removed from patients suffering a recurrent attack and in these specimens all stages of inflammation may be observed. The acute exudative and suppurative phases are found superimposed on a background of tissue previously inflamed but now scarred and indurated. Sparcity of tubules—few if any are normal—and marked overgrowth of connective tissue with a corresponding decrease of vascularity in these areas is characteristic. The clinical recurrence of an epididymitis means the vas and some tubules are still patent and suggests probable fertility of the side involved, although it is conceivable that in these cases the epididymitis results from a lymph borne infection.

Moreover, the histological study of the inflamed epididymis causes one to emphasize not that sterility follows bilateral involvement in over 40 per cent. of the cases, but that any of these patients may be fertile following such an attack. Such studies further advance the argument in favor of a liberal attitude toward the early performance of epididymotomy; early drainage presumably will tend to lessen tubular destruction.

Changes in the testicle are those of collateral inflammation. If the attack is of recent onset, acute passive congestion with a variable degree of cloudy swelling may be observed. With suppurative extension from the epididymis, massive destruction of the testicular tubules with ultimate total gangrene ensues. This is not uncommonly seen in those patients whose surgical treatment has been delayed; perhaps the clinical indications for operation have passed unheeded or unrecognized. The testicle is lost by necrotic slough or orchidectomy.

The pathological process in the vas deferens is histologically the same as that of the epididymis (Fig. 12). The lesion is most severe in proximity to the globus minor where abscesses of the duct are occasionally encountered. Repair is a sclerotic process and not infrequently results in occlusion of the vas (Fig. 13) and may account in some instances for the failure of epididymovasostomy to cure sterility.

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