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RECENT ADVANCES IN THORACIC SURGERY (Part I)
CHARLES D. SCHAEFFER, M.D., F.A.C.S.

Progress in the field of intrathoracic surgery has been extremely rapid. When we realize that the field has really only been open since the first pneumonectomy for malignancy performed by Graham 20 years ago, we can't help feel that all the advances made are recent ones. This means that we can not consider the entire field of chest surgery, but in two papers will review the more common and important surgical conditions in the chest.

CHEST INJURIES

During World War II principles underlying the management of serious injuries to the chest were tested against a tremendous volume of experiences. Many concepts, proved valid after extensive trial, are directly applicable to the severe chest injuries encountered in civilian practice and in the casualties of heavy industry and high-velocity automobiles.

Churchill has emphasized the importance of distinguishing two phases of chest trauma: the serious disturbance of cardiorespiratory physiology that demands prompt and intelligent treatment; and the problem of infection, which requires fully as intelligent but less urgent attention. We suggest, now, that the urgent physiologic disturbances that attend wounds of the chest can be controlled by needle aspiration of air and blood (prompt reexpansion of the lung), aspiration of blood and mucus from the tracheobronchial tree, novocaine injection of the intercostal spaces, insertion of a catheter with underwater negative pressure for pressure pneumothorax, oxygen therapy and transfusions, and debridement of sucking wounds with hemostasis of intercostal vessels and approximation of deep structures of the chest wall to close the pleural opening.

The late effects of intrapleural bleeding with clotted hemothorax or chronic hematoma of the pleural space were responsible for one of the more dramatic surgical developments of the war—namely, pulmonary decortication. The aim of the procedure is early restitution of pulmonary function, and the avoidance of the late, crippling effect of extensive fibrothorax. In the uninfected clotted hemothorax, decortication was carried out four to six weeks after trauma if there appeared, by X-ray examination, to be lateral pulmonary compression of 50% or more; if there were obvious limitations of chest expansion; and if there was clinically significant shortness of breath. It was believed that prior to three weeks after injury, the peel was not sufficiently tough to permit satisfactory removal, and that after that...
time fibrous changes were found in the lung. In cases of infected hemothorax, the time of operation was advanced to about two weeks after trauma. Signs of increasing toxicity, mounting fever, or rapid increase in the size of the hemothorax were considered presumptive evidence of infection. The mortality is less than 2% and less than 25% residual empyemas, most of which were small and basal.

The latest advance in this field has been the use of streptokinase and streptodornase, enzymatic solutions, that are injected into the pleural space or empyema cavity. After a suitable period of time, perhaps 18 to 24 hours, the solution is aspirated. Usually the clot will be entirely liquefied and one aspiration will suffice. However, occasionally two or three will be necessary.

CANCER OF THE LUNG

This is one of the most discouraging problems that we have in this field at the moment. The problem revolves about the fact that the diagnosis must be made early in these cases, just as we wish it for cancer in any part of the body. In my own limited private practice, I have seen 33 cancers of the lung in 18 months and three of these have been operable. All of these patients had symptoms for several months before consulting their family physician and then, to make matters worse, the latter observed them for periods varying from a few weeks to many months before consulting a specialist. This is an extremely dangerous practice.

It is essential, then, that we stress the earlier diagnosis of this condition. Cancer of the lung may mimic any other condition of the lung. Intensive study must be carried out to prove or disprove its presence. Usually men (7:1) between 40 and 60 years of age make up most of the cases, but age and sex are no exemption. The important points in a review of symptoms are change in cough habits; persistent, unexplained or rationalized X-ray shadow; persistent streaking of the sputum and the cold that hangs on.

One of the more important recent advances in the diagnosis of cancer of the lung has been the increasing use of cytologic studies of the sputum or of bronchial secretions. As in any precise laboratory maneuver, great attention must be paid to the details of collecting and preparing the material, and considerable judgment must be exercised in interpretation of specimens.

<table>
<thead>
<tr>
<th>Test</th>
<th>Positive Rate</th>
<th>False Positive Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum</td>
<td>82% (varies from 60% up)</td>
<td>3.2%</td>
</tr>
<tr>
<td>Bronchial washings</td>
<td>40-70% positives</td>
<td>1-3%</td>
</tr>
</tbody>
</table>
All reviews indicate that cytologic examination of sputum will give a higher percentage of positive results than bronchoscopic biopsy. However, false-negative reactions do not rule out cancer.

Besides, bronchoscopy often will reveal an inoperable tumor which from all other studies seems operable. Bronchography is rarely indicated in these cases.

EARLIER DIAGNOSIS OF CANCER OF LUNG

1. History of recently developing cough or change in character of a chronic cough should make one suspicious of cancer of lung.

2. X-ray of the chest can make the presumptive diagnosis in 90% of patients. A normal X-ray does not completely rule out cancer and should be disregarded in the presence of symptoms.

3. A solitary nodule in the lung seen on X-ray, whether or not accompanied by symptoms, should be considered as cancer until proven otherwise by biopsy, which should be performed immediately.

4. Physical examination of chest is often inconclusive and variable.

5. Early symptoms indicate X-ray, followed by bronchoscopy with examination of aspirated secretions, or biopsy if the lesion is seen. Lower respiratory symptoms, or a mass, or both, indicate further study is necessary.

6. Although cancer of the lung is more common in men over 40, it may be found in younger men or women.

7. Cancer is found just as often in persons with tuberculosis as those without.

8. Small operable lesions are usually asymptomatic and this is the type of tumor we wish to treat.

9. Cancer often may be the cause of atelectasis, lung abscess and other complications in which case the cancer may easily be overlooked.

10. Routine chest X-rays. All persons over 40 should have chest plates at least once each year, and oftener if necessary.

11. Early diagnosis promises cure. Late diagnosis results in disappointment.

Any palpable nodes in the neck or supraclavicular area should be biopsied before surgery. The treatment of choice is total pneumonectomy with accompanying excision of all draining lymph nodes. However, in the poor risk case, a lobectomy or segmental
resection may have to be done so that the patient will not become a respiratory cripple after surgery. The operable mortality is comparable with major abdominal surgery for we lose less than 1 in 10 postoperatively.

Results of treatment indicate that about 40% are operable when first seen by the specialist. After exploring the lung, only about half of this 40% (22%) are suitable for resection. The five year cure in these cases now seems in the neighborhood of 20-25% of resected cases.

TUBERCULOSIS

There also has been progress in the treatment of tuberculosis. Only recently have accepted techniques been generally applied to excisional surgery. Since tourniquet lobectomy has been replaced by individual ligation technique, the incidence of many hazards have been reduced.

At present the long term results of lobectomy for this disease still await definition and a new technical consideration—the use of streptomycin—has entered the picture. Streptomycin therapy for tuberculosis has had extensive and critical trial in the facilities of the Veterans Administration. The combination of this drug with surgical procedures is of proved value. The drug has more than halved the postoperative spreads which formerly occurred. We also feel that thoracoplasty should follow or be done at the first stage for excisional therapy in this disease. It also should be mentioned that segmental resection has a definite place in this surgery and thoracoplasty may or may not be done depending upon the amount of lung removed. New drugs constantly are being evaluated in the treatment of this disease and it is very likely that a chemical cure will some day replace surgery except in those cases with lung destruction.

SUPPURATIVE DISEASE

A. Lung abscess

Perhaps some of you have witnessed the prolonged disability from chronic lung abscess in which external drainage was employed. Today primary lobectomy, or occasionally pneumonectomy is employed in this condition. Fortunately, since the widespread use of antibiotics, this condition is rarely seen. We urge resection in cases in which secondary, presumable irreversible, changes have occurred; in those anatomically unsuited to drainage; in those associated with excessive bleeding; in children; in patients in whom cancer cannot be excluded; and in cases secondary to unremovable foreign bodies.
B. Bronchiectasis

Surgical progress in bronchiectasis has been largely that of increasing safety and selectivity of operative procedures. More effective supportive measures, technical advances and extension of anatomic knowledge have contributed to the wider application of segmental resection and bilateral programs. There can be little doubt that penicillin has contributed greatly to the safety and ease of convalescence of these patients, and there is clinical evidence that aerosol penicillin may be of some help as a preoperative measure, especially in cases with copious amounts of sputum. Endotracheal anesthesia has greatly decreased the operative hazard of flooding of the airway at the time of surgery. Bronchoscopic aspiration is a prime essential in the postoperative care of these patients, particularly the bilateral cases. At this time we feel that the better side should be done first so that respiratory compensation will be more satisfactory, especially during the second operative procedure.

ESOPHAGUS

A. Cancer

Cancer of the esophagus differs from cancer of the lung in that its symptoms are generally so urgent that by far the great majority come to exploration, the age of the patient and his general condition notwithstanding. The distressing symptoms of slow starvation and the inability to swallow one's own saliva justify considerable operative risk and discomfort. The palliation afforded these patients if, at operation, resection and anastomosis are feasible, has been deemed ample justification for the risks and surgical efforts involved, even if the prospect of cure is dim or nonexistent. Unfortunately, the anatomic relations of the esophagus make involvement of adjacent vital structure likely, though collected statistics indicate that the present resectability rate of 60% explored compares favorably with that of carcinomas elsewhere in the gastrointestinal tract.

Carcinomas of the midesophagus requiring a high resection and usually an anastomosis at the level of the ante-aortic or supra-aortic arch should be distinguished from those demanding a low resection. The midzonal cancers represent patients for whom, until 1944, the Thorek operation was the only generally accepted procedure. In that year, Garlock and Sweet independently reported their experience with resection and primary intrathoracic anastomosis for these high and difficult lesions.
Mortality (Sweet)\textsuperscript{101}

| Low resection | 109 cases | 12% |
| Midthoracic    | 72 cases  | 23.6% |

Most of the deaths from midthoracic surgery are from cardiac disorders making medical consultation mandatory.

Perhaps the most difficult of all zones to resect, and fortunately the least commonly involved, is the upper fourth of the thoracic esophagus. Cancer at the thoracic inlet is difficult of access, for both removal and reconstruction. Sweet \textsuperscript{100} has reported some success with intracervical esophagogastrostomy, bringing the fundus of the stomach up through a defect in the upper thorax formed by resection of the inner end of the clavicle and first rib. Other methods are described but seem less physiologic. \textsuperscript{64-65-86}

Cancer of the cervical esophagus has stubbornly maintained the upper hand over surgical attack, although occasional successes in this region have been reported. The technique of cervical esophagectomy has been described in detail by Wookey.\textsuperscript{114-115} The procedure is designed to reestablish esophageal continuity at a second stage, and in many cases the larynx can be preserved. One of the major difficulties has been the delay in diagnosis, occasioned chiefly by the surprising vagueness and lateness of symptoms, scabby throat, halitosis and ill defined discomfort in swallowing.

B. Benign Obstructions

It is not surprising that heroic measures refined to a point of safety in the treatment of cancer of the esophagus should be extended to include certain benign but often distressing conditions. Thus, although bougienage may be adequate for certain benign obstructions, in a variable number of patients it will be distasteful to the point of intolerability and occasionally impossible or extremely hazardous. Under these circumstances, resection and direct esophagogastric anastomosis seems logical, especially with normal cardiopulmonary systems.\textsuperscript{102}

Various intriguing procedures have been developed for high strictures but can not be discussed here.\textsuperscript{64-65-86-102}

In the adult particularly, the surgical attack of diaphragmatic hernia is best done through the chest, with an equivalent mortality but lower recurrence rate than through the abdomen.\textsuperscript{75-104-56-107} The indications for operation for these lesions mainly include intractable pain, incarceration and acute or chronic blood loss.

[59]
C. Congenital Atresia

This is a very distressing condition that is found in the new born child. There are several types, varying from esophageal atresia to tracheoesophageal fistulas. At the present time, we prefer to restore esophageal continuity but in a certain percentage of cases this is not possible and multiple-stage procedures are required. These aim first at closure of the tracheoesophageal fistula, cervical esophagostomy, ligation of the lower esophageal segment, some form of gastrostomy and finally reconstruction of an anterior esophagus.

Pulmonary complications have been a limiting factor in this correction. For this reason, small amounts of lipoidal are preferred over barium for X-ray diagnosis. Operation must only be postponed until the physiologic needs of the infant are satisfied.

MISCELLANEOUS CONDITIONS

A. The removal of mediastinal tumors is an important subject. Tumors include bronchogenic cysts, intrathoracic goiters, neurofibromas, aneurysms, meningocele, pericardial cysts, and many others. These should be removed whenever possible.

B. It is well to mention here that metastatic, particularly, single tumors to the lungs are resectable, even with the hope of cure or prolonged palliation, when the primary tumor has been adequately treated and no other metastases are found.

C. It should be mentioned that the surgery for severe intractable asthma has largely been given up at the present time.

—Bibliography will be furnished on request.
SOME INTERNAL DISEASES AND THEIR ASSOCIATED FUNDAL CHANGES

CHARLES P. GOLDSMITH, M.D., F.A.C.S.

HYPERTENSIVE VASCULAR CHANGES IN THE FUNDUS

The etiology of hypertension is varied and the manifestations in the fundus are in no way characteristic of any one type of hypertensive disease. The only essential requirement for the production of changes in the retina and its vessels is an elevated blood pressure. Other conditions may be contributory, but as yet they have not been elucidated. Although ophthalmoscopic findings may not be specific for a particular disease, they offer an excellent means for detecting changes in arterioles and the effect of these changes on the retina. Experience has shown that such observations are important for the proper management of hypertension. When they are correlated with other clinical and laboratory data, a more accurate evaluation can be made of the disease as it affects the individual patient. Before discussing the significance of changes found in some of the different types of hypertension, a brief description will be given of the retinal lesions and their pathology.

The retinal vessels are classified as arterioles but differ from arterioles in other parts of the body in that the thickness of the vessel wall is only one tenth the diameter of the lumen. Histopathologic studies of these vessels in hypertension show that the development of sclerosis is similar to that observed in other organs, although there may be a difference in degree. The vessels show hyaline degeneration and thickening of the media which is primarily due to a multiplication of the elastic elements since there are very few muscle fibers. Occasionally the intima becomes involved and it encroaches upon the lumen. These anatomic changes are responsible for the alterations in the ophthalmoscopic appearance of vessels and the column of blood they contain. Two early signs of sclerosis are described as widening of the light reflex and increased luster of the arterioles. Later, the reflex becomes coppery in color and the veins are compressed at their intersection with arterioles. In more advanced degrees of sclerosis, the arterioles acquire a silver color and are narrowed, altering the A-V ratio. The veins become further compressed. Finally, the lumen may be almost completely obliterated and the arteriole appears as a fibrous cord. The appearance of the vessels may not be uniform since pathologic changes are not equally distributed. It is not unusual to find a difference in the degree of sclerosis in various vessels and variations in the course of the same
The sclerotic process may be limited to a focal area. The observer's impression of the amount of visible change noted in the retinal arteries is the basis of grading the degree of sclerosis.

Another vascular change associated with hypertension is vasospasm. This may occur in a normal or a sclerotic vessel. If vasospasm persists, sclerosis will develop. Spasm may appear as a generalized narrowing of the entire vascular tree or it may be limited to segments of a vessel. Spasm is graded according to the reduction in caliber of the arterioles and the extent to which they may be followed to the periphery of the fundus. In extreme degrees the vessels may appear as threads which can not be followed beyond the secondary branches. The criteria for distinguishing arteriolar spasm from sclerosis are not reliable. The only certain sign is the widening of an attenuated vessel as it is observed periodically.

Retinal lesions may appear in the course of hypertension and they are referred to as retinopathy rather than retinitis. These lesions include hemorrhages, cotton-wool exudates, macular star, retinal edema and edema of the disc. The hemorrhages are usually flame-shaped because of their location in the nerve fiber layer. Other types may appear in the deeper layers. Cotton-wool patches have a varying pathologic background. They may represent areas of edema, fibrinous exudate or cytoid bodies. Friedenwald has been able to show that this lesion develops as a result of an ischemic infarct in the nerve fiber layer. The ischemia may be produced by spasm or thrombosis. Retinal edema in the region of the macula reveals the radiating arrangement of the nerve fibers around the fovea. When edema is absorbed there may remain as permanent evidence of its presence, punctate white lesions in the nerve fiber layer of Henle which form a star-like figure. These lesions are due to hyaline and lipoid deposits. They also may be observed in other areas of the fundus where edema and cotton-wool patches were once present. In the most severe cases of hypertension, papilledema or neuroretinal edema may appear and it is frequently associated with an increase in the intracranial pressure.

There are wide variations in the extent to which a retinopathy manifests itself. Some patients may show a few hemorrhages or exudates, or both. In others, all types of lesions may be present. Since some degree of arteriolar constriction is almost always present, the term angiospastic retinopathy is often used to describe the picture presented by these lesions. Retinopathy is always associated with evidence of vascular change. If there has been no pre-existing hypertension, the arterioles will appear markedly attenuated due to generalized and focal constrictions. Where hypertension has been present, the vessels present a mixed picture of sclerosis and spasm.

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The appearance and course of a retinopathy closely follow the general condition of the patient. The lesions may completely absorb, for example, upon recovery from acute nephritis or toxemia of pregnancy or upon the removal of the cause. If the retinopathy persists, recurs or becomes progressive, the prognosis is poor. The appearance of edema of the optic nerve makes the outlook even more grave.

A complete study of vascular hypertension should include a survey of all disease processes in which elevated arterial pressure may be present. This presentation, however, will be limited to a discussion of essential and malignant hypertension, acute and chronic nephritis and the toxemia of pregnancy.

Essential hypertension is used in the broadest sense and includes a neurogenic type and the type characterized by a transient elevation of blood pressure. Ninety-five percent of patients manifesting an elevated blood pressure are from this group and those with malignant hypertension. There are many classifications of the fundus findings in essential hypertension, but the one that seems to have the broadest and most significant clinical application is that described by Wagener and Keith. They divided hypertensive patients into four groups and their observations over a five year period show a definite correlation between fundus findings and life expectancy. In group I they placed those patients who showed little or no vascular change. Group II included patients whose retinal vessels were definitely sclerotic and they usually showed some degree of vasospasm. No retinopathy was present. Group III was characterized by the appearance of hemorrhages, exudates or both in addition to vasospasm and sclerosis. In Group IV were those patients who had malignant hypertension and classification in this group depends upon the presence of papilledema. The other vascular and retinal abnormalities almost always were present but occasionally only papilledema and vasospasm were seen. Studies made on patients in the four groups show corresponding alterations in kidney function, electrocardiogram changes, heart size and average blood pressure readings. In Group I these clinical and laboratory findings either are normal or show slight deviation from the normal. In Groups II and III there is a gradual progression of these changes. The concentrating power of the kidney diminishes, lowering the specific gravity of the urine. The heart tends to enlarge and the blood pressure becomes fixed at higher levels. Group IV almost always shows evidence of severe damage to the heart and kidneys.

Although the use of this classification offers an excellent way to interpret retinal findings, it should be recognized that there are exceptions. This is particularly true when the internists and the ophthal-
mologists attempt to correlate their findings in evaluating the individual patient. The disease process may effect one organ much more than another. Occasionally the fundus may show only moderate changes while the kidney or heart are seriously damaged. The selection of medical or surgical treatment should be based on a consideration of the complete picture. Periodic observations of the fundus should be made on all hypertensive patients. The appearance of a retinopathy would be the first sign of a sudden acceleration in the disease process. If papilledema appears, the malignant phase of the disease has developed and this makes the outlook extremely grave.

The clinical course of acute and chronic nephritis demonstrates the relationship between the development of hypertension and the appearance of lesions in the fundi. When the blood pressure becomes elevated in these diseases, definite changes can be observed in the eye grounds. The retinal vessels show constriction and a retinopathy may occur.

The clinical manifestations of acute nephritis are extremely variable. There may be only urinary findings or the disease may have a very dramatic onset with the sudden appearance of a hypertensive encephalopathy. Although the classic picture of acute nephritis includes hypertension, it is frequently absent or not detected. When present, it is very often mild or transitory. For these reasons, lesions of the fundus are not very common in this disease. In the presence of moderate or transitory hypertension, ophthalmoscopic examination may reveal no abnormalities or a slight degree of vasospasm. If the picture of angiospastic retinopathy appears, prognosis is usually serious. It is possible for recovery to take place with healing of the kidney lesions and absorption of the retinopathy. However, this is rare. Occasionally there may be evidence of severe renal damage with no alteration in the blood pressure and no changes in the fundi.

In chronic nephritis, fundus changes are most commonly observed since hypertension occurs more frequently. Where there is a sustained elevation of blood pressure, sclerosis of the retinal vessels will be present. Acute vasospastic episodes may occur and in addition to vascular spasm, hemorrhages and exudates may be noted in the fundi. These acute episodes may coincide with recurrent inflammatory lesions of the kidney. The appearance of a retinopathy in the course of the chronic nephritis is generally regarded as a very serious sign. In the terminal stages, papilledema may develop and the ophthalmoscopic picture may be indistinguishable from malignant hypertension. Even with the aid of other clinical and laboratory information, it may be impossible to differentiate between these two diseases. Two other factors may play a role in the development of retinal lesions. One is secondary
anemia, a common finding in chronic nephritis. This may be responsible for the appearance of anemic retinopathy and does give the disc a pallor. The other is hypoproteinemia, a reversal of the albumin-globulin ratio as a result of albuminuria. Diminution in blood proteins produces a generalized edema which manifests itself in the retina. If it becomes marked, a bilateral exudative detachment may appear in the lower half of the retina. This is usually a terminal finding. Occasionally renal function is impaired to the point where albuminuria decreases and azotemia develops raising osmotic pressure of the blood. Fluid is withdrawn from the tissues and the retinal picture may improve but in reality the patient is worse. Some patients with chronic nephritis will show a progressive loss of kidney function, terminating in uremia without the appearance of hypertension at any stage of the disease. Ophthalmoscopic examination of such patients may reveal no abnormalities. On the other hand retinal lesions may be present due to alterations in blood protein or the presence of a secondary anemia.

In the presence of toxemia of pregnancy, examination of the fundi has proved to be a valuable aid in the management of this complication. In the milder cases where there has been no previous vascular disease, the fundi may appear normal or there may be a slight narrowing of the arterioles due to angiospasm. This is usually most marked beyond the secondary branches. If the toxemia is severe, exudates and hemorrhagic lesions will develop and neuroretinal edema may appear. The edema may be so massive as to produce a separation of the retina. In cases where there has been previous hypertensive disease, the retinal vessels will show some degree of sclerosis and the acute lesions will be superimposed on sclerotic vessels. Retinal lesions are usually proportionate to the height of the blood pressure and the degree of albuminuria and edema. The eye grounds reflect the severity of the disease and changes in the retinal picture may be the first indication as to whether the process is advancing or receding. This is an important factor in deciding whether or not pregnancy should be terminated. The amount of permanent damage is determined by the severity and duration of the toxemia. Complete recovery is possible in the angiospastic stage since the vascular changes are reversible. After delivery, blood pressure returns to normal, the retinal vessels resume their normal caliper and if a retinopathy was present, it absorbs. Where permanent vascular damage develops, it is manifested by arteriolar sclerosis and chronic hypertension.
DIABETES MELLITUS

The development of diabetic retinopathy is unrelated to the severity of the diabetes. It was long believed to be the result associated with retinal arteriosclerosis and hypertension. Although the two conditions are frequently associated in persons of the older age group, hypertension and the retinopathy of diabetes are separate entities—clinically and histologically. In both conditions the earliest recognizable lesions are pathological changes in the retinal vessels, but in diabetes these lesions affect primarily the venous side of the retinal vessels and in hypertension they affect primarily the arterial side. While arteriosclerosis and diabetes are often associated, there are many diabetics in whom there is no evidence of arterial disease. This is particularly true in young diabetics. Bloch reports among his cases that of a woman, age 26, with diabetes of 15 years' duration and typical diabetic retinopathy. There was no evidence of arterial or renal disease. The blood pressure was 125 systolic and 90 diastolic. O'Brian and Allen found diabetic retinopathy in four per cent of a series of young patients without hypertension or arteriosclerosis. Wagener and others have shown that the duration of the diabetes is the most important factor in the production of a retinopathy. Wagener found that 83% of all patients who had diabetes for over 20 years had diabetic retinopathy and that the incidence was as high in the cases of controlled diabetes as in the cases of uncontrolled diabetes.

Wagener divides the development of the retinopathy into five stages which he describes as follows:

1. The earliest sign is the appearance of one or one capillary aneurysms which formerly were called small deep hemorrhages. The aneurysmal sacs are often incompletely lined with endothelium.

2. The next stage is marked by the development of tiny punctate hemorrhages, chiefly in the macular area. At this stage the exudates begin to appear. This is the central punctate retinitis of Hirschberg. They are solid, soapy or waxy looking, yellowish in color with well defined sharply cut edges. Distributed irregularly in the central area, they frequently form a circle around the macula. As time goes on, these exudates tend to coalesce into lardaceous irregular masses interspersed with dark, gray pigmentary degeneration.

3. In a third stage, cotton-wool patches develop and may indicate the onset of complicating hypertension.

4. Visible changes in the veins occur in a fourth stage or may, in some instances, follow stage II. When retinopathy occurs in young
diabetics, this change may even occur as the initial lesion. The veins dilate, develop nodules and become ensheathed. Under the microscope, the veins appear sclerosed, the walls showing variations in thickness, hyaline degeneration, areas of endothelial proliferation and thrombosis. At this stage multiple thrombi may develop as well as larger hemorrhages, deep and round rather than superficial. The central retinal vein may undergo total obstruction.

(5) In the final stage, there are recurrent vitreous hemorrhages which are followed by retinitis proliferans. This occurs in only about 1.5% of the patients but it is an exceedingly important condition since it usually leads to detachment of the retina and blindness. The retinitis proliferans in diabetes originates at or near the disc with development of a profusion of newly formed blood vessels which appear in advance of any noticeable amount of connective tissue. These vessels often show a brush-like arrangement and the endings in the vitreous form either coil-like convulsions or loops returning to the disc. In the older diabetic, the retinopathy is likely to pass through all five of these stages but as noted above, it may start with Stage IV in young patients who have been kept alive with insulin.

ANEMIA

In severe anemias there are frequently found changes in the retina which are related to the severity of the anemia. This is especially the case in pernicious anemia. The fundus is pale with more of a yellowish color, but may appear normal even with a severe anemia. The vessels on the optic disc are pale and thin, becoming more red and full after leaving the disc. The optic disc is pale but otherwise normal in many cases. In some cases there is a blurring of the margin of the disc, due to an edema which occasionally causes a real swelling of the disc. The edema may extend into the nerve fiber layer of the retina for some distance, causing a vale-like opacity. The vessels in the retina are either normal in appearance or they are slightly tortuous. In the retina there are seen hemorrhages which are irregularly distributed, not very numerous and either radial, flame-shaped or round. Some have a white center. The hemorrhages increase with the severity of the anemia in pernicious anemia and are soon reabsorbed with the improvement of the blood condition. A few cotton-wool patches are also seen and some sharply defined deeply situated white exudates. In severe secondary anemia the ophthalmoscopic picture is similar to that seen in pernicious anemia with some variations. The hemorrhages are apt to be less in number, the vessels are more dilated and tortuous and the edema of the disc is more marked.
LEUKEMIA

In the leukemias, the ophthalmoscopic picture is characterized by changes in the vessels, hemorrhages and blurring of the disc margins. The veins are dilated, often to three or four times the diameter of the arteries and are tortuous. They are frequently constricted at intervals, resembling a chain of sausages. The arteries are of normal diameter or they are slightly dilated and tortuous. In most cases, the veins appear slightly paler than normal and have more of a pink color. Some veins are accompanied by fine white lines. The fundus as a whole has more of an orange color. The optic disc is frequently edematous and the margins are blurred. The edema extends as a vale-like opacity into the retina, near the disc. Occasionally the swollen disc projects for several diopters with a typical appearance of a choked disc. It must be kept in mind that on a rare occasion, papilledema may be the result of increased intracranial pressure due to a leukemic tumor in the brain. The hemorrhages are of various sizes and shapes, radial, linear, round and irregular. Frequently they contain a white center. They vary from a few small ones to a great number of scattered extravasations over the entire fundus. The hemorrhages tend to increase with the degree of anemia. Preretinal hemorrhages occur with occasional rupture into the vitreous. The exudates which are not so frequent as the hemorrhages consist of sharply defined white patches and of cotton-wool patches. Some of the exudates are surrounded by a hemorrhagic border. Visual disturbances occur only when the macula is involved, when the hemorrhages are extensive or when there is a hemorrhage into the vitreous. Occasionally a massive hemorrhage into the vitreous leads to a secondary glaucoma. Fundus changes are not found in every case of leukemia. They average 70% changes in acute cases and 63% in the chronic cases of leukemia.

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ACUTE SCROTAL EMERGENCIES
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There are many acute scrotal and testicular conditions in several of which early diagnosis may result in saving the part involved. In this presentation we are primarily interested in acute epididymitis, torsion of the testicle and torsion of the appendix testis (hydatid of Morgagni). Needless to say, a differential diagnosis must be made with other acute conditions as acute orchitis, strangulated hernia, hematocoele, tumor and the more unusual conditions of infarction and thrombophlebitis.

ACUTE EPIDIDYMITIS

Acute epididymitis is encountered frequently as a primary condition associated with specific or non-specific infections of the lower ureterogenital tract or secondary to trauma in hernial repairs, prostatectomy, transurethral procedures or systemic disease. Under pressure, retrograde spread of urine or pus may occur down the vas to the epididymis, or infection may be blood born.

Regardless of the etiology, the symptoms are usually acute with varying degrees of pain, chills, fever and swelling which may be delayed for 12 to 72 hours. Early pain may be entirely lower quadrant, inguinal, rectal or low back and a differential must be made from acute ureteral conditions and acute appendicitis. Later the scrotal contents are tender, particularly the tail of the epididymis and the cord, with edema of these structures. The skin becomes reddened, taut and shiny and the testicle hangs low and feels heavy. Prehn's sign (alleviation of pain on elevation of the scrotum) is positive. Rectally, the seminal vesicle may be enlarged or tender. The associated finding of an urethritis, prostatitis or pyuria adds credence to the diagnosis. Fortunately nearly all acute epididymides respond to our present day antibiotics and sulfonamides with associated elevation of the scrotum, ice and bed rest. Occasionally the time honored epididymotomy must be resorted to when pain is not relieved by the usual measures.

Epididymitis is associated with cremasteric spasm and papaverine hypodermically in one grain doses or, perhaps more dramatically, infiltration about the cord at the base of the scrotum with 10 cc. of 1% procaine in each quadrant, will give almost instant relief of muscular and vascular spasm.

Patient E.B., white male, age 37, was seen with a grade I papillary carcinoma of the right ureteral ridge just above the orifice. The tumor
was removed transurethrally with a deep bite in the bladder wall, followed by fulguration of the base. Twenty-four hours later he developed severe chills and fever and 72 hours later a full blown epididymitis appeared due to thermal damage to the seminal vesicle.

Patient R.O., age 49, was seen with pain in the right testicle following lifting. Examination revealed a tender, enlarged epididymis with the suggestion of slight spotty induration of the testicle. He had a low grade temperature, prostatic infection, a bacilluria and diabetes. Treatment of the diabetes and infection showed some improvement but not as much as anticipated and operation two weeks later revealed an early seminoma of the testicle.

TORSION TESTIS

Characteristically, torsion testis occurs in the prepubertal and adolescent age group with sporadic cases in the later decades. Muschat, in his extensive paper on torsion of the testicle, and all subsequent authors agree that the predisposing factor is some congenital anomaly usually allowing freedom of mobility of the testicle in its tunic and the exciting factor some sudden stimulation producing cremasteric spasm. There are, however, several reports of cases being initiated during sleep.

In contradistinction to epididymitis the systemic complaints and findings are nil. The onset is usually sudden, occasionally with nausea and vomiting and at times with varying degrees of shock. In most cases there is very little temperature elevation, unless, as in long standing cases, necrosis has set in.

On physical examination, in addition to slight shock, the patient may have some relief with the leg in flexion. Prehn's sign is negative. The affected testicle is riding high at the base of the scrotum and is acutely tender making examination most difficult to differentiate testicle from epididymis and cord. A thickened cord can usually be palpated, but definite torsion is very often not discernible. Very early edema of scrotal skin occurs with slight redness and apparent fixation of the skin to deeper structures. The associated hydrocele is not always demonstrable. As time elapses, the scrotal mass enlarges and may become three to four times normal size, later becoming deeply discolored due to underlying necrosis.

The treatment here, of course, is early diagnosis with immediate surgery and a goal of saving the affected testicle and prophylactically protecting the opposite side by fixation of the testicle in its sac. The percentage of misdiagnosis is high and no time must be lost once the diagnosis is made. At operation, upon exposing the tunica vaginalis,
the hydrocele fluid is evident beneath which can be seen a discolored mass. On complete exposure, the mass is seen to be a dusky or necrotic testicle and epididymis with partial or complete vascular obstruction of the cord due to twisting of varying degrees. The torsion is held by most authors to occur from mesial side out or inside out. Probably the greater percentage of cases are not seen until gangrene has set in and orchidectomy is mandatory. Of those not gangrenous, fixation by suturing the lower segment of the cord and the excised scrotal sac and preventing later torsion is necessary. Later atrophy with sterility must be considered.

Patient W.H., 16 years of age, was seen six days after an acute right testicular pain had awakened him from his sleep. He was treated as an acute epididymitis with penicillin and sulfonamides until seen in the hospital six days later with a temperature of 98.6 degrees, WBC 19,100 with 80 per cent polymorphonuclear forms. There was no urethral discharge. The right scrotum was markedly swollen with an exquisitely tender mass pulled high at the base of the scrotum. The testicle could not be differentiated from the epididymis. The skin had a dusky hue. The scrotal mass did not transilluminate and attempted elevation aggravated rather than relieved the pain. Immediate operation revealed a gangrenous testis and epididymis with 180 degree torsion of the cord. Detorsion seemed to offer some vascular improvement and orchidectomy with fixation of the opposite side was done at a later admission.

Patient S.H., one day of age, was born at 10:47 P.M. on May 5, 1951. The nurse reported inflammation and swelling of the left scrotum. Twenty hours later a pediatrician was consulted and immediately consultation was requested because of swelling and redness of the left scrotum. It was impossible to differentiate structures and operation 26 hours after birth revealed a completely gangrenous testis, epididymis and lower cord with a 360 degree twist of the cord. Orchidectomy was done under local anesthesia. Because of the age of the patient and no parental consent, no other procedure was done. The parents have been cautioned and operation recommended on the other side.

Patient C.M., age 20, was admitted with a history of infrequent attacks of pain in the stomach and nausea at which time the testes had appeared slightly swollen and very tender. Ice bags usually relieved the condition. A diagnosis was made of torsion testicle on the left with hydrocele. At operation, on opening the left scrotum, approximately 20 cc. of straw colored fluid was liberated and the testicle was found unattached to the epididymis. No gubernacular
attachment could be found. There was a congenital absence of a vas. The testicle was fixed by suturing the tunica vaginalis to the scrotal wall. The right scrotum was then opened and the right testicle was found attached with a gubernacular band. Again the tunica vaginalis was sutured to the scrotal wall to fix the testicle.

Patient C.R., age 15, sex, questionable, was admitted to the hospital with pain in the left lower quadrant. Consultation was asked for when the nurses were unable to catheterize the patient. The patient complained of monthly nasal hemorrhages lasting a few minutes at a time without any previous trauma, burning on voiding and nocturia. Because of the physical findings and apparent unusual build of the patient, a more detailed history was taken from the mother. The mother stated that she always wanted a girl and after this child was born she was dressed and raised as a girl. At times male clothing had been given her but she refused to wear it. She had only one male and one female companion. The mother stated the patient had a violent temper and usually played girls games, not partaking in any male sports. On physical examination she appeared to have a male build with broad shoulders and narrow hips. She wore her hair long, although it was quite kinky. There was hair growth on the upper lip and the hair on her head was very coarse with a thick growth on the eyebrows and chin. There was no breast development. The abdomen revealed tenderness in the left lower quadrant but no definite masses. The genitalia revealed a female hair distribution with a suggestion of small labia. There were no apparent testes. The phallas was enlarged to a length of two inches with the urethral meatus in the perin- eum. It was impossible to pass a finger in the vagina due to a very limited introitus. Rectal examination revealed no pelvic viscera. X-rays demonstrated a congenital spina difida. The blood count revealed a leucocytosis of 23,400 with 83 per cent polymorphonuclear forms. Because of the acuteness of her complaints, a lower abdominal laparotomy was done. No pelvic organs were found. There was a congenital absence of the appendix. In the left inguinal region near the internal ring was a normal sized testicle in a partial state of torsion. The testicle was placed in a normal relationship to the other structures and fixed to them with several fine chronic catgut sutures since no permission had been obtained to proceed with any corrective procedure. The mother had previously prohibited any attempts to change or alter the sex of this individual.

Patient A.W., age 12, was admitted with a temperature of 99.6 degrees and a history of noticing a pain in the right scrotum one week before admission after having taken a bike ride. The following day he noticed
swelling. The patient was not seen until the day of admission to the hospital. Examination suggested a torsion of the testicle and immediate operation was done. Upon opening the tunica vaginalis, bloody fluid was liberated. The lower third of the cord was found twisted one and one half times. Detorsion of the cord did not restore circulation to the testicle and epididymis and an orchidectomy was done. A pathological report revealed a degenerated hemorrhagic testis and epididymis.

Patient E.M., age 37, was seen at home with a temperature of 99.4 degrees. He had been treated for four days with penicillin as an acute epididymitis. Examination revealed a large ovoid swelling of the right testicle and scrotum. The testicle itself appeared to be enlarged and riding high in the scrotum with a deep pigmentation of the scrotal skin. The patient complained of a dull constant pain in the mass referred to the inguinal region. At operation a 360 degree twist of the cord with complete strangulation and gangrene was found and orchidectomy was performed. Leucocytes were 10,220 with 74 per cent polymorphonuclear forms.

Patient A.S., age 21, gave a history of recurrent infrequent bilateral testicular pain. Initiation of this attack occurred while playing touch football. On examination, the patient was lying in bed turning from side to side with both thighs flexed and both testes drawn up to the base of the scrotum. Examination of the testes was possible, suggesting torsion of the cord on the right. It was impossible to definitely palpate torsion on the left. Temperature 99.4 WBC 8,300 with 74 per cent polymorphonuclear forms. Immediate operation was done bilaterally. Upon exposing both testes, the right had a 180 degree torsion of the lower third of the cord and the left had no torsion. There was a congenital absence of the gubernacular attachment bilaterally. Both testicles were fixed in their scrotal sacs by placing several No. 000 chromic catgut sutures along the lower cord and epididymis, fixing the structures to the posterior scrotal wall. This patient apparently has had no interference with spermatogenesis since he was married and had fathered one child.

TORSION HYDATID MORGAGNI

The appendix testes, according to Arey, is the vestigial remnant of the cranial end of the Mullerian ducts. There have been few reports of torsion of this anatomical abnormality. Randall in 1938 gave credit to Colt for the first report of an operated case in 1902, although earlier reports subsequently appeared. He then reviewed the literature and reported two cases to make a total of 68 reported cases. The anatomy, pathological anatomy and symptom complex were described with early
bilateral operation recommended. Livermore in 1948 reviewed the literature and reported a case in a 10 year old boy. Coppridge and Roberts reported cases in 10 and 12 year old patients. The initial symptoms again, with torsion of the appendix, may occur with many exciting influences producing cremasteric spasm or they may occur spontaneously with varying degrees of pain in the lower inguinal region and frequently noticed by the parents is some form of protective gait. The local symptoms are not as severe as in torsion testis. Examination of the scrotum reveals tenderness and swelling with slight redness of the scrotal skin. Usually, however, with cooperation of the patient, the testicle can be handled and palpated.

Patient R.S., age 12, noticed a right scrotal swelling 24 hours before admission and previously had had pain in the right groin one week before the admitting symptoms. The swelling appeared suddenly and was noticed on arising in the morning. There was no discoloration to the skin. The right scrotal sac was swollen and tense and was painful on slight pressure of the examining hand. The left scrotum also was slightly swollen. The patient was lying quietly in bed with no temperature elevation and a normal blood count. Immediate operation revealed a gangrenous appendix epididymis. A ligature was placed about the gangrenous appendix epididymis. The epididymis and cord were sutured to the posterior scrotal wall with No. 000 chromic catgut.

Patient C.A., age 9 years, was seen with moderate pain in the left scrotum. The mother noticed the patient walking with a stiff leg on arising in the morning. Examination revealed slight redness over the dependent portion of the scrotum. The testicle was not elevated but there was moderate tenderness on examination. Temperature 100 degrees, WBC 5,000 with 53 per cent polymorphonuclear forms. Immediate operation revealed a gangrenous appendix testis. The pedicle was ligated with No. 000 chromic catgut and dropped back into its normal position in the scrotum. The pathological report revealed necrotic tissue with many red cells and lymphocytes.

Patient J.M., age 10 years, was seen in the office with a history of pain in the right testicle and guarding on walking. The patient had been to school that day and was not hindered by his complaints. Examination revealed slight swelling and redness in the dependent portion of the scrotum with no elevation of the testicle. A presumptive diagnosis of torsion of the hydatid was made and operation deferred. The patient was seen again the following morning. He was much improved and there was less tenderness and swelling. No operation was done. Since that time the patient has had no apparent atrophy.
Patient J.W., age 7, had been seen for a possible appendicitis 48 hours before the examination. The patient's mother noticed that the boy walked with a limp although he ate well, went to school and offered no complaints. Examination revealed the boy walking, splinting the right thigh. There was slight elevation of the right testis with edema and slight redness of the right scrotal skin to the base of the scrotum. The cremasteric reflex was present. There was no apparent elevation in skin temperature. The entire scrotal mass was acutely tender. Prehn's sign was negative. On admission to the hospital temperature was 99.8 degrees, WBC 7,000 with 60 percent polymorphonuclear forms. Immediate operation with a tentative diagnosis of torsion of the hydatid or possible torsion of the testicle revealed, on opening the scrotal sac, moderate edema with some discoloration of the cord. No torsion of the testicle could be demonstrated. There was a gangrenous appendix testis which was ligated with No. 000 chromic catgut. The pathological report revealed a fibrinous mass infiltrated with many erythrocytes and leucocytes.

CONCLUSIONS

Two unusual cases of apparent epididymitis are presented; the one masquerading a testicular tumor and the other a direct complication of electro-coagulation.

Seven cases of torsion of the testicle are presented, four of which were gangrenous requiring orchidectomy. One case, diagnosed the day of birth, was found gangrenous.

Torsion testis is primarily due to a congenital anomaly and operation should immediately be done bilaterally to restore circulation to the affected side, if not already gangrenous, and fix the cord and epididymis to the scrotal wall with interrupted sutures; and to prophylactically fix the unaffected side if the anomaly is present.

Three cases of torsion of the appendix testis and one of the appendix epididymis are presented. Simple ligation of the pedicle with amputation of the gangrenous appendage is all that is required. A presumptive diagnosis was made on one case and operation deferred with no apparent damage subsequently.

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ABSCESSES AND FISTULAS OF THE ANORECTUM

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An abscess in the anorectal area, as elsewhere, is a localized area of infection which culminates in the collection of purulent material. Such infection is more frequent in males in the ratio of two to one, possibly due to irritation of tight clothing and the trauma incident to occupation.

Staphylococcus, streptococcus and coliform organisms are usually found in abscesses. Occasionally pyocyanous, proteus, actinomyces, tubercle bacilli and gonococcus are found.

Approximately five percent of patients suffering from anorectal disease are found to have some type of manifestation of abscess.

The direct or exciting cause of anorectal infection is the entrance of pyogenic bacteria in the adjacent loose areolar tissue. By virtue of the arrangement of the crypts or Morgagni, normally found at the anorectal line, approximately ninety per cent of the abscesses have their origin here. However, trauma to the rectal mucosa or perianal skin may provide an avenue of infection. For many years physicians have been interested in spread of infection from the crypts to the pararectal spaces. A recent study has amply confirmed previous observations that epithelium-lined ducts are to be found in human embryos and adults. These ducts may provide pathways for spread of infection.

The majority of abscesses result in fistula formation. The site of origin is termed the primary opening and the terminal end the secondary opening. The fistula may drain continuously or intermittently, in which case recurrent abscess formation would be possible.

There are instances in which, for some reason or other, the abscess is not opened and drainage occurs in retrograde fashion through the primary opening, thus constituting an incomplete or "blind" fistula.

Generally, in a given case, only one primary opening is present. In contrast, it is not unusual to discover two or more secondary openings.

The indirect or pre-disposing causes of abscess and fistula include the following: malnutrition, diabetes, tuberculosis, malignancy, dysentery, regional enteritis, chronic ulcerative colitis, perianal dermatitis, retro-rectal tumors and cysts, osteomyelitis of the pelvic bones, pelvic abscesses, prostatitis and vesiculitis, trauma, foreign body and malformations. The majority are due to localized non-specific infection.
Localization of an abscess may occur below or above the levator ani muscles. If it occurs below the levator muscles, the abscess should be classified further as ischio-anal, perineal, posterior levato or post anal (sub-sphincteric). If it occurs above the levator, it should be identified as either retro-rectal or pelvi-rectal. These abscesses may occur as a combination of two or more of these types, and for this reason anatomic knowledge is essential to proper diagnosis and treatment.

Diagnosis and treatment is simplified by dividing abscesses and fistulae into two general groups. The first group, by far the larger, are of local origin and may be treated entirely by local measure. The second group, which represents the unusual type of disease, must be diagnosed and treated locally as well as managing the underlying disease.

With thorough knowledge of the regional anatomy, it should be possible to diagnose the various types of abscesses by inspection, digital and proctosigmoidoscopic examination.

As a general rule abscesses, with the exception of the submucous type or those pelvirectal or retro-rectal, which have partially opened through the rectal wall, are best approached externally well away from the sphincter mechanism. The superficial ones are widely uncapped and gently explored with a finger to break down any inflammatory bridges or necrotic tissue. They are lightly packed for a day or two to insure proper healing. The pelvirectal abscesses are drained by an incision lateral to the anus, gradually deepening it through the ischio-rectal fossa and levator. The retro-rectal abscess is approached by an incision just lateral to the anococcygeal raphe. Submucosal abscesses are opened intra-rectally and frequently it is possible to extend the incision to the involved crypt and thus avoid a subsequent fistulectomy. The posterior levator abscess is opened by an almost horse-shoe shaped incision around the posterior and lateral portions of the anus. In this type of abscess the anococcygeal raphe may be allowed to remain intact as the two imbs communicate with one another through the sub-sphincteric space. This type of management also applies to the posterior horse-shoe shaped abscess.

In the smaller abscesses, when the primary opening is readily found, it is frequently possible to avoid subsequent fistulectomy by completing the incision to the involved crypt.

The treatment of the inevitable fistula is simplified when one recognizes that with few exceptions the primary opening is found in one of the crypts. It is usually best to wait a few weeks after the
considered in addition to those already mentioned: abscess associated with appendicitis, abscess associated with anal fissure, rectovaginal or rectovesicle fistula, pilonidal cysts, retrorectal dermoid cysts, Bartholin cysts, pyoderma, lymphatic abscess, actinomycosis, osteomyelitis, penetrating injuries, lymphopathia venereum, congenital dimples, large hair follicles and chromaffin bodies.

SUMMARY

The etiology, pathology, differential diagnosis and treatment of anorectal abscesses and fistulas have been briefly discussed.

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