POST-GRADUATE MEDICAL JOURNAL

A Review on PRURITUS ANI

By G. O. CHAMBERS, F.R.C.S.

A/Assist. Surg. and in charge Proctology Clinic, West London Hosp.; late Clin. Asst. St. Mark's Hosp.; Visiting Surg., H.M. Prison, Wormwood Scrubs Hosp.; Cons. Surg., Free French Forces

Anal irritation, or pruritus ani, is a very common complaint. It is, perhaps, more frequently met with in men than in women. No age is exempt, although it is relatively uncommon in young adults. Children are affected in association with thread-worms, or during an attack of eczema with an underlying allergic diathesis.

There is often a seasonable variation, the complaint being more frequent in the warmer months than in winter.

Pruritus has always a local origin.—In many cases an abnormal constitutional condition, with altered blood concentration, and an emotional or highly nervous temperament, may predispose.

It is characterised by an intense itching or burning sensation, usually of sudden onset, beginning near the anal margin and spreading peripherally over the buttocks and perineum. It frequently lasts several days. The attack often starts at night, as soon as the patient has settled in bed and become warm and comfortable.

The irritation persists, and sleep is rendered impossible. Later, it may develop into paroxysms of great severity, and cause marked impairment in health both physical and mental.

In early and mild cases no skin changes may be visible, though slight redness and superficial excoriation from scratching are often present. In chronic and more severe cases the skin undergoes marked changes. Thickening, corrugation, fissures, rugae, and discharge from secondary infection, form the typical picture. Most of these changes are due to the effects of constant scratching which make treatment more prolonged and difficult.

The essential cause of pruritus may be considered as a local focus of irritation producing stimulation of terminal nerve-endings from oedema and altered tissue tension in the skin.

It has been observed by Macleod and Muende,¹ that the dermal lymph passes between fibrous bundles, epithelial and fat cells, in the tissue spaces and that there are comparatively few endothelial lined lymphatic vessels. Researches by Key and Retzius have demonstrated that the lymph circulates in the epidermis—passing in at the

apices of the papillae and oozing back into the corium at the interpapillary processes.

In pruritus, proliferative changes occur in the skin mainly affecting the prickle cell layer. Swelling and thickening of these cells are seen. In the corium there is dilatation of the subpapillary and mid-dermal venous plexuses. Oedema, lymphatic stagnation, and capillary dilatation are present throughout the area.

These skin changes have been described by Riddoch,² who stresses the importance of oedema as a result of stasis in the external haemorrhoidal venous plexus.

He suggests that this may be the cause of idiopathic pruritus. In cases where internal haemorrhoids may be present, treatment by injection removes the back-pressure effects of local congestion, relieves the stasis, and cures the pruritis. It is possible that these subcuticular changes, associated with oedema resulting from local stasis, may explain most early cases of pruritus ani.

Theories regarding the pruritic stimulus.

Histologically, it may be recalled that, among the principal cutaneous receptors, there are free nerve-endings terminating within the cells of the prickle layer.

There are, also, other end-organs, such as the basket-endings at the root of hair follicles.

Any change of tissue tension around these receptors will be passed on as an afferent stimulus by each.

Other end-organs, such as Meissner's tactile corpuscles and Krause's end-bulbs, come into the picture as the stimulus continues in persistence and chronicity.

A slight rise in temperature, a pull on a hair, or sudden drop in tissue tension, as when lying down at night, may provoke the stimulus.

The impulse passes by way of medullated fibres through the cutaneous branches, chiefly inferior haemorrhoidal and perineal branch of the 4th sacral nerves, to the posterior grey cornua in the spinal cord. Thence by the spino-thalamic tract to the thalamus, and, finally, by cortical fibres to the grey cerebral cortex to be interpreted as the cutaneous sensation known as itching.

According to Livingston,³ this sensation is thought to be derived from some combination of the four primary modalities of cutaneous sensibility—touch, pain, heat, and cold. Each is subserved by a specific receptor to transmit only one kind of impulse.

The theory implies that pain is subserved by

undifferentiated type of nerve-endings; cold by Krause's end-bulbs; heat by the corpuscles of Ruffini and Golgi-Mazzoni; touch by Merkel's discs, and basket-endings of the hair follicles.

Zotterman's observations, regarding sensory stimuli, hold that a central inhibitory effect is exerted on "protopathic" fibres by "epicritic" fibres within the spinal cord.

He subscribes to Foerster's view upon the sensations of tickling and itching. In this it seems that the fast impulses travelling up the posterior columns inhibit the central effect of the later arriving impulses; the less the large fast fibres are stimulated, the more intense become the tickling and itching sensations elicited by slow impulses.

Rubbing an itching area is an instinctive reaction giving some degree of relief. It belongs to the group of instinctive reactions such as squeezing the hands, rubbing an injured part, or biting the lips in control of painful sensations, all of which have a definite and modifying effect on pain threshold.

One would expect to find evidence of chronic neuritis in the peri-anal region so richly supplied with sensory nerves. Histological examinations conducted by Montgomery,⁴ and others have failed to show evidence of such changes, although these nerves are constantly exposed to stimuli from congestion and oedema in addition to hypertrophic skin changes and secondary infection in later cases.

Lockhart-Mummery,⁵ however, is of opinion that in any old-standing case definite disease of the nerve-endings is present owing to the effects of constant scratching.

The prevailing causes of pruritus ani may thus be classified:—

1. *Excessive anal moisture.*

- (a) Sweating and lack of cleanliness, especially amongst those engaged in arduous work or heated atmosphere—miners, stokers, and the like. Also, those involved in prolonged and uncomfortable sitting positions, such as lorry and bus drivers.
- (b) Discharge from infected or congested skin tags, fissure, ulcer, condylomata, hypertrophied anal papillae and inflammation of the sinuses of Morgagni (Cryptitis). Also, fistula-in-ano. Discharge may be due to a leaking ano-rectal abscess or to proctitis whether simple, specific, or of the venereal type commonly recognised as lymphogranuloma inguinale.

Anal epithelioma and rectal carcinoma are, of course, associated with chronic foetid discharge.

- (c) Mucoid leak from the rectal mucosa may arise from congested internal piles, especially with prolapse, and rectal polypi. Passive congestion of the rectum associated with sphincter spasm in cases of chronic constipation of the rectal type, may give rise to mucoid leak. This condition of spasm produces in time a deposit of fibrous tissue known by Miles as the "Pecten band." It is a common abnormality in cases of pruritus ani, and is termed pectenosis (Abel).⁶

Weakness or paresis of the external sphincter, together with prolapsus recti, is a frequent cause of mucous discharge. Mucous colitis may be another cause, since it invariably extends to and affects the mucosa of the rectum.

Drug idiosyncrasy, strong aperients, phenolphthalein mixtures may excite excessive mucous secretion, whilst the intake of large or prolonged amounts of liquid paraffin may produce a constant seepage or leak of this aperient through the anal canal.

- (d) In women, moisture may be derived from pruritus vulvae, often found associated with the anal condition. In these cases, the presence of vaginal discharge—particularly that due to the *Trichomonas Vaginalis*—may be the focus, Cervical erosion, a malignant disease should likewise be mentioned. Chronic cystitis with contamination from septic urine is a frequent cause of vulval and anal irritation.

Idiopathic pruritus in the female of the vulvo-anal type may occur in women suffering from hypochromic anaemia.

Achlorhydria may or may not be present.

There is, also, an idiopathic variety found in post-menopausal patients in whom atrophic changes of the vulva and adjacent soft tissues, due to endocrine deficiency, are present. A somewhat similar condition occurs frequently in old age.

2. *Parasites.*

- (a) Thread-worms, as a cause of pruritus ani, are often found in children and young adults. *Oxyuris vermicularis* may gain entrance by eating uncooked vegetables, salads, or through contact with an infected person by hands, towels, etc. These worms are very small, about $\frac{1}{4}$ in. in length, like little white threads, and very motile. They are elusive and may need several examinations for detection. They are most likely present in the anal canal or lower rectum towards the evening, when they tend to descend from the higher part of the rectum, causing

PHYSIOLOGICAL MECHANISM OF PRURITUS ANI

irritation from their movements. A low saline washout at such a time, together with examination on a dark plate, will reveal their presence.

It may be stated that thread-worm infection, as a cause of pruritus ani, is far more common than is usually recognised—especially in present times.

It should always be given careful investigation.

- (b) The nematode, *Enterobius vermicularis*, is a not uncommon cause of pruritus. Its normal habitat is the appendix and caecum. The female worm descends to the rectum to deposit its ova. The movements of these worms are the cause of the irritation and scratching. The ova become implanted on the fingers, and the patient constantly reinfects himself.

A saline wash-out, with microscopic examination of the residual deposit, will usually determine the diagnosis.

- (c) Scabies and pediculosis are sometimes found as causes of anal irritation. In the former, similar lesions of the acarus may be detected on the wrists, between the fingers, and elsewhere.

3. *Mycotic diseases.*

Fungi and pathogenic yeast moulds may affect the perianal skin and give rise to a chronic form of pruritus ani. They are rare infections. Such lesions show desquamation, vesiculation, and a circumscribed well-defined border. There are often deep or superficial fissures in the skin so affected. A certain amount of intertrigo and lichenification may be present. Inspection of the clefts between the toes, in particular between the 4th and 5th, often reveals desquamatory changes due to mycotic infection. *Tinea cruris*, also, proves the diagnosis. A chronic streptococcal infection of the perianal skin may be difficult to distinguish from such an appearance, and it may be the primary cause of the irritation.

It is possibly due to the constant rubbing of infected faeces into the skin after defaecation.

In both there may be a well-defined border, but in streptococcal infection the edges are usually bright red and smooth, whereas, in a mycotic condition, they are dull pink and papular. Among the latter, a secondary infection may be super-added and mask the typical picture.

Microscopic and cultural examinations may reveal the epidermophyton or trichophyton fungus. Culture is often very slow and difficult to attain.

In yeast infections, the *Monilia Albicans* is the easier to recognise, as it gives an earlier and richer growth on Sabouraud's maltose agar.

4. *Chronic idiopathic pruritus.*

Such cases, unfortunately, comprise a group which has lasted for months or years, where no local focus has been found and for whom all kinds of treatment have been given with little or no permanent relief.

Weariness, depression, and a chronic anxiety state gradually supervene, and mental changes ensue in the worst cases. It is probable that, in most of these, a trivial undetected local cause has been present.

It may have since disappeared, or, if discovered, was inadequately treated.

Nevertheless, in a sensitive, temperamental subject with lowered threshold to pain and irritation, the urge for scratching remains dominant and, apart from intervals of latency, becomes progressive and uncontrollable.

The initial psychological impulse is sufficient to provoke a local vaso-dilatation and oedema with stimulation of sensory nerve-endings in the prickle cell layer.

Reflex autonomic stimuli through the segmental arc suffice to maintain this process of exudation and altered tissue tension.

Prognosis

Most cases are amenable to treatment where the local focus can be found.

A certain number are extremely resistant and show a tendency to relapse.

This is sometimes due to non-co-operation on the part of the patient and to the irksome nature of the treatment.

Complete confidence and willingness in carrying out the full ritual of treatment are essential for success.

In early cases with active evidence of pruritus, a better prognosis can usually be given than in those where no skin lesions are visible.

Gabriel⁷ estimates that 90 per cent, providing the cause is rightly diagnosed, are readily amenable to treatment.

Lockhart-Mummery⁸ considers that cases of more than two years' standing are very difficult to cure, and the removal of the local lesion, even if present, seldom stops the itching.

The chronic idiopathic variety are, of course, the most resistant.

Some are relieved or, at least, improved by psychological treatment.

EXAMINATION

A careful and complete investigation is necessary.

The history, with any physical bearing or

psychological background, should be fully worked out.

Worry, marital troubles, sexual deviations should be noted for any possible influence on the case.

Abnormal mental make-up, hysterical manifestations such as patchy anaesthesia, exaggerated knee-jerks, etc., are often present in the persistent and obstinate type of pruritus. Underlying constitutional disease may require investigation. Dietetic errors, excess of laxatives such as liquid paraffin and phenolphthalein compounds, or drug addiction, should be ascertained.

Urine examination for the presence of sugar, albumin, and acid or alkaline reaction must be carried out as a routine on all cases. Bacteriological examination will be required in cases of cystitis associated with pruritus vulvae.

In blood investigations, the Wassermann reaction will be necessary for suspected syphilitic lesions, and the Frei antigen test for the diagnosis of lymphogranuloma inguinale—an obscure venereal disorder more often seen abroad, but a not infrequent cause of pruritus in this country. Its main feature is chronic inflammation of the mucosa and periproctitis leading ultimately to stenosis and rectal stricture.

A differential blood count and haemoglobin estimation will be required for anaemia. The hypochromic variety is often found in women with pruritus vulvae.

Achlorhydria may be present in association with this type of anaemia, and should be investigated by fractional test-meal. In women, gynaecological examination will be required for the presence of vaginal or uterine disorders. In men, the prostate and seminal vesicles may need investigation.

In either sex an old gonococcal infection should not be overlooked. Direct pus smears and complement fixation test should be carried out.

Pathological examination of muco-pus or faeces may be required; the detection of parasitic ova has already been mentioned. Finally, a biopsy may be necessary of any suspected neoplasm found during the course of investigation.

To carry out the local examination, a suitable proctoscope of the Gabriel or Milligan pattern and a good light—such as the Anglepoise—are essential.

The position of the patient is the next consideration.

The left lateral position, with a suitable sand-bag under the lower buttock, is convenient and comfortable.

In the male, the knee-elbow position can be utilised with advantage. A more complete examination can be made with the finger, and, upon introduction of the proctoscope, the rectum

becoming distended with air and gaping owing to negative pressure from gravity effects on the abdominal contents, a more extensive view is thus obtained.

Unless adequate local examination is carried out, an unexplained and persistent case of pruritus may be relegated to the list of idiopathics, whereas the discovery of a chronic catarrhal proctitis or an infected crypt might easily explain the cause of the irritation.

In the case of suspected colitis or new growth in the upper rectum or lower colon, sigmoidoscopic examination must be carried out. It may be mentioned that mucous colitis always affects the mucosa of the rectum. If this appears healthy, there is no colitis, and the presence of blood and mucus must come from some other cause, usually a neoplasm.

TREATMENT

(1) *Hygiene*.—In all cases careful attention to cleanliness is most important. This alone will cure a large proportion. The anal region should be thoroughly washed with lukewarm water, using a white curd soap, night and morning and after defaecation. Careful drying with a soft towel should be followed by the prescribed local application. Cotton wool should be used after the act of defaecation instead of paper. Local body ventilation is also important. Aertex cellular cotton mesh, silk or artificial silk underclothing, loosely fitting, should be substituted for heavy woollens or much darned and coarse materials. The same applies to night apparel.

Hairy subjects are much benefited by perineal shaving whilst undergoing treatment.

(2) *Diet*.—Over-indulgence in food and drink must be corrected. Highly seasoned foods, condiments, curries, etc., should be avoided. Meat should be restricted. Shell-fish, strawberries, strong tea and coffee, as occasional causes of pruritus, are likewise forbidden. Moderation in alcohol and tobacco should be exercised, but, if possible, it is wiser to stop all alcoholic drinks. In colitis, where irritating mucus may lead to pruritus, the dietary should be overhauled and any idiosyncrasy corrected. In most cases a simple light diet, including milk, butter, fresh fruit and vegetables, with avoidance of acid-forming foods, should be prescribed.

(3) *Medicinal*.—The daily action of the bowels needs due attention. If laxatives are required, senna is probably the best drug. It has a more selective effect on the lower part of the large intestine. Milk of magnesia is also recommended. Any vegetable aperient, however, may be tried. Saline aperients and phenolphthalein should not be given owing to their irritative effects on the

mucosa. Liquid paraffin may be used in moderation and for a given period, but its tendency to accumulation and seepage, causing anal leak, should not be forgotten.

Owing to the nocturnal nature of this complaint with consequent loss of sleep, luminal can be given in $\frac{1}{2}$ gr. doses night and morning; or, if so desired, in $\frac{1}{2}$ gr. doses at night only.

Luminal is regarded by many as almost specific in its effect on pruritus and lends support to the large neurotic factor in this condition.

Adalin, bromidia, and the like, may be tried alternatively in milder cases.

Morphia and opiates should never be given owing to the risk of drug addiction.

Ultra-violet light is often beneficial both as a local application as well as general body radiation.

In cases of avitaminosis, a course of vitamin A as cod-liver oil or haliverol should be given.

Where achlorhydria is present, hydrochlor. acid dil., $\frac{1}{2}$ to 1 drachm in water thrice daily should also be administered. Cases of hypochromic anaemia should be treated with ferrous sulphate in combination with acid hydrochlor. dil.

In vitamin C deficiency, black-currant jelly or syrup, or ascorbic acid tablets, 50 mgm., may be taken twice or thrice daily.

Endocrine dysfunction in post-menopausal patients should be treated with stilboestrol or other oestrogenic preparations.

(4) Local treatment.

a. Surgical.—The extensive group of ano-rectal disorders that have already been enumerated will require surgical treatment. Such direct causes of pruritis as piles, fissure, prolapse, etc., when adequately dealt with, will be followed by permanent cure in most cases.

The injection of internal piles, excision of skin tags, cauterisation of hypertrophied papillae, may be cited as such instances of minor surgery.

Neoplasms and the more extensive conditions will require appropriate investigation and treatment.

b. Local applications.—Magnesia lotion applied morning and evening is very efficacious in early cases.

The following formula is used at St. Mark's Hospital:—

R Phenol	.. ..	1 drachm
Zinc oxide	.. ..	2 drachms
Pulv. calamine prep.	.. ..	1 drachm
Glycerine	.. ..	2 drachms
Sp. Recti	.. ..	2 drachms
Aq. rosae	.. ..	$\frac{1}{2}$ ounce
Milk of magnesia ad.	.. ..	4 ounces

Later, or as an alternative, a dusting powder such as Calamine 1 part, Starch powder 2 parts, may be used. This can conveniently be applied in the morning, and the lotion in the evenings. A pledget of wool containing this lotion may be interplaced in the anal cleft at night time.

Ointments are generally contra-indicated owing to their greasy nature and impermeability, sometimes causing irritation. They are occasionally useful in dry dermatitis and in chronic or suspected mycotic conditions.

In such cases Aird Scott recommends the use of Whitfield's ointment:—

R Benzoic acid	.. ..	2 $\frac{1}{2}$ grns.
Salicylic acid	.. ..	2 $\frac{1}{2}$ grns.
White petroleum jelly	.. ..	120 grns.
Coconut oil	.. ..	ad. 1 oz.

This should be sparingly employed, and may not be tolerated for long. It may be replaced by Ichthiol paste with the addition of Oil of Cade, 20 mins. to the ounce.

The formula of Ichthiol paste is:—

R Ichthiol	.. ..	40 mins.
Zinc oxide	.. ..	120 grns.
Lanoline	.. ..	120 grns.
Petroleum jelly	.. ..	ad. 1 oz.

In acute dermatitis, Miles has found the following very useful:—

R Pulv. zinc ox.	.. ..	2 drms.
Lin. camph.	.. ..	3 drms.
Anaesthesin..	.. ..	2 drms.
Lanoline	.. ..	1 drm.

Alternatively, Lockhart-Mummery recommends this formula:—

Bismuth subnitrat	.. ..	2 drms.
Cocaine	.. ..	10 grns.
Hydrarg. subchloridi	.. ..	15 grns.
Vaseline	.. ..	1 oz.

In chronic cases with fissures and excoriations, Gabriel finds that healing is often obtained by painting the skin with Silver nitrate, 30 grains to the ounce, Bonney's violet-green paint may also be tried, or Blanchard's I-B paint.

The formula of the latter is:

R Tinct. Iodi.	CCP triturate formula:—
Tinct. Benzoin Co	R Camphor
CCP triturate part.	Chloral hydrate
aq.	Phenol part. aeq.

Any of the above paints may be applied once or twice weekly.

I-B paint is much used at St. Mark's Hospital on selected cases.

Patients should be advised to avoid scratching the part with the finger nails. Pinching the irritable part outside the clothes does less harm and affords some relief.

Treatment must be continued for several months in spite of apparent cure, otherwise the pruritus may return.

When an attack of irritation is threatened, the application of 2 per cent carbolic lotion with spirit and rose-water will often prevent its development. A pledget of cotton wool soaked in this lotion should be inserted in the anal cleft. The lotion should be kept handy at night-time.

Gynaecological conditions will, of course, require appropriate treatment apart from that directed to the relief of pruritus ani.

(5) *Parasitic.*

a. *Oxyuris vermicularis* should be treated by strong saline injections—2 tablespoonfuls to 1 pint of warm water. This should be injected into the rectum at night-time by ordinary enema syringe. A dose of castor oil should have been given previously to clear the bowel.

b. *Enterobius vermicularis* is treated by giving Santonin 2 grains and Calomel 1 grain (Adult dose) for three nights in succession. Thymol may alternatively be used: A purge is first given followed next morning by Thymol $\frac{1}{2}$ drachm, repeated in two hours by another $\frac{1}{2}$ drachm. A saline purge is given two hours later.

A strong saline injection of the strength already mentioned—four ounces—should be carried out at the time of irritation, which corresponds to the probable presence of the female worms in the rectum.

Adequate precautions must be taken against re-infestation.

c. The treatment of scabies is carried out by sulphur applications. *Pediculosis* is treated by shaving and the usual mercurial ointment.

(6) *Local injection treatment.*

Various sclerosing drugs injected deep into the perianal tissues have been advocated. Dilute hydrochloric acid, alcohol, and quinine-urea have produced sclerosis with successful result in freedom from pruritus. This has been obtained chiefly by those few who have worked with these drugs. There is considerable risk of sloughing and other complications, and their general use is not recommended. The oil-soluble anaesthetic preparations, on the other hand, are safe and valuable in the treatment of obstinate cases where local surgical and medical attention have failed to dispose of the irritation.

Injection by these drugs should, therefore, be

reserved until local means have been tried over a varying period.

It is then preferable to have the patient in bed for a few days, either in hospital or nursing home, while the injection treatment is being carried out, and local applications can be more carefully and regularly given.

Yeomans first described the use of an anaesthetic solution in almond oil in 1927, and produced the solution known as Benacol.

Since 1929 a solution called A.B.A. was produced by Gabriel and prepared by Allen & Hanbury. This has been most popular and satisfactory, and used by many in this country.

It consists of 3 per cent solution of anaesthesin with benzyl alcohol 4 per cent and ether 10 per cent in sterilised olive oil.

Recently another solution, devised by Morgan, and known as Proctocaine, is most successful in its results. Like A.B.A., it is frequently used in the treatment of anal fissure.

It contains Butesin 6 per cent, Benzyl alcohol 5 per cent, Procaine base 1.5 per cent in sterilised almond oil.

As regards technique, scrupulous cleanliness and the usual aseptic ritual must be observed.

The anal skin must be cleansed with soap and water after shaving, and tincture of iodine applied to the whole area. A sedative should be given beforehand.

The patient should be placed on the left side, and the lower buttock suitably elevated with a sandbag.

Usually 4 punctures are made, two on either side of the anus postero-laterally, and about 8 to 12 ccs. are injected. A deep radiating injection of 2 to 3 ccs. is made in each, seeping should be avoided, and gentle massage with the finger in the rectum will prevent this. Care, of course, must be taken to avoid puncture of the anal canal. A second injection of a smaller amount in 2 punctures of 2.5 ccs. each may be given in 7 to 10 days' time if required.

By this means the sensory nerves in the ischio-rectal fossa, inferior haemorrhoidal and 4th sacral (perineal branch) are anaesthetised.

It is usually advisable to continue sedative treatment, such as bromidia, during the following few days.

A sensation of numbness in the perianal region is produced and lasts a few weeks, but the irritation disappears at once. Local treatment can be applied with more effective results.

It may be said that with increasing experience in examination, and correct local treatment, the use of these injections should only occasionally be required in treating pruritus.

Special surgical operative treatment, such as Ball's operation by undercutting the perianal

skin, or division of peripheral nerves, as in Stoeffel's operation, are not popular with most surgeons. The results are unsatisfactory. The technique of Ball's operation is difficult to carry out, although appearing easy on paper, and the rationale of dividing definite nerve lesions being sound.

Lockhart-Mummery, however, states he has performed this operation since 1905 with excellent results, and advises it in old standing cases.

Deep X-ray therapy is not recommended owing to various risks involved in skin changes and frequency of relapse.

REFERENCES

1. MACLEOD, J. M., and MUENDE, I., *Pathology of Skin*.
2. RIDDOCH, JOHN W., *Lancet*, 1937, 1, 919.
3. LIVINGSTON, W. K., *Pain Mechanisms*.
4. MONTGOMERY, H., *Mayo Clinic Monographs*, 1931.
5. LOCKHART-MUMMERY, J. P., "Treatment of Pruritus Ani," *Post-Graduate Med. J.*, October 1934, pp. 429-434.
6. ABEL, LAWRENCE, *Brit. Med. J.*, 1939, p. 627.
7. GABRIEL, W. B., *The principles and practice of Rectal Surgery*, pp. 189-204, 1937.
8. LOCKHART-MUMMERY, J. P., *Brit. Med. J.*, 1929, pp. 1070-1071.
9. LOCKHART-MUMMERY, J. P., *Diseases of the Rectum and Colon*, 1934.

SURGICAL CLOSURE OF THE PATENT DUCTUS ARTERIOSUS

By O. S. TUBBS, F.R.C.S.
(Surgeon E.M.S. Chest Unit.)

Interest in persistent patency of the ductus arteriosus has increased greatly since surgical ligation of this vessel was first successfully performed by Gross in August 1938 (Gross and Hubbard, 1939). Munro (1907) suggested such an operation in infants, but it was not till Strieder (Grabel, Strieder and Boyer, 1938) attempted its performance in an adult that the practical possibilities of this procedure received serious consideration. Further interest has been stimulated by the demonstration that some cases complicated by subacute bacterial endarteritis can be cured of their infection by ligation (Tourof and Vessell, 1940, and Bourne, Keele and Tubbs, 1941).

Up to the present time about 200 cases of patent ductus arteriosus have been treated surgically, and it is therefore time for a careful review of the results obtained and the indications for and technique of the operation. Nine of my own 12 cases have been ligated in the presence of endarteritis, and the importance and frequency of this complication will receive particular attention.

Pathological Effects of Persistent Patency of the Ductus Arteriosus

During foetal life the ductus arteriosus is a relatively large vessel connecting the bifurcation of

the pulmonary artery to the aorta, and has the important function of allowing a large part of the right ventricular output to enter the aorta without passing through the pulmonary circulation (Fig. 1). Normally the vessel becomes functionally closed within a few minutes of birth (Barclay *et alia*, 1942), almost certainly as a result of contraction of

FIG. 1.—Diagrammatic representation of the foetal circulation (arrow in the ductus showing the direction of blood flow).

its extraordinarily well-developed muscle coat (Kennedy and Clark, 1941). Anatomical obliteration of the lumen follows within the first few months of post-natal life. The cause of patency persisting into childhood and adult life is entirely unknown (it is interesting to note that it remains patent twice as frequently in females as in males), but when it does so the flow of blood is reversed, i.e. oxygenated blood flows from the aorta into the venous stream in the pulmonary artery (Fig. 2)