out the necessary psychological investigation and treatment, but he usually lacks the training required for such a task, and in any case the time element makes this impracticable in most hospital clinics. It therefore seems justifiable to include a psychiatrist and a psychiatric social worker in every gynaecological team. The psychiatric assessment and, so far as possible, the psychotherapy of a patient with well-defined gynaecological symptoms should take place within the framework of the clinic to which she has been referred, and it should not be necessary to divert her to another department, even in the same hospital. The importance of combined therapy has already been stressed, and this necessitates the closest co-operation between gynaecologist and psychiatrist.

Much neurosis with a genital background is attributable to ignorance and to faulty upbringing. In particular the incidence of frigidity and dyspareunia could be reduced by improved premarital education, including not only sex instruction but also general mental hygiene and the real value of family relations. Much unhappiness and even illness could be obviated by wider—and wiser—dissemination of proper contraceptive advice, with due regard to the temperament and character of the couple and to their religious beliefs. Midwives, health visitors, and even doctors often impress on patients the danger of further pregnancies without mentioning existing facilities for contraceptive instruction and without regard for the personal prejudices or ethical beliefs of the woman and her husband.

The prevalence of conditions of overcrowding, and the part played by ill-assorted family relations in producing many of these functional disorders, as outlined above, suggest that in some cases they might be regarded as equal with tuberculosis and other organic diseases in placing a couple high on the list of priorities for new houses.

Finally, in considering the relative importance of psychic and of somatic factors in the production of disease and disorder of the pelvic organs, and in reaching a decision on the method of treatment, a compromise must often be reached : as suggested by Deutsche (1947), the psychiatrist must always have the courage to give up, at the right moment, his own hopes of healing the patient psychically whenever the gynaecologist can eliminate an important defect more quickly ; and the gynaecologist must be prepared to withhold his knife and even his hormones when the psychiatrist advises that their use may have bad psychological results. He must also be prepared to operate, on some occasions, even in the absence of demonstrable organic disease, if his colleague can be reasonably sure that only removal of the uterus or repair of the pelvic floor will finally reassure the patient and abolish her anxiety state.

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According to a report which appeared in the *Daily Telegraph* of Aug. 17, the Airborne Forces Security Fund has financed a scheme for maintaining eight patients at a time in a special chalet attached to a sanatorium at Leysin, Switzerland. The scheme was devised for the assistance of 28 former paratroopers who are ill mainly as a result of prison camp conditions, and the arrangements at Leysin have been made because hospital accommodation was not available for many of these men in Britain.

CENTRALIZED GONOCOCCUS CULTURE FOR DISPERSED CLINICS

THE VALUE OF A NEW TRANSPORT MEDIUM FOR GONOCOCCI AND TRICHOMONAS

BY

MARY MOFFETT, M.B., D.P.H.
JEAN L. YOUNG, M.B., D.P.H.
AND
R. D. STUART, M.D., D.Sc., D.P.H.

(From the Public Health Venereal Disease Service and the Central Public Health Laboratory, Glasgow)

This paper considers the use of bacteriological cultural methods in the diagnosis and control of gonorrhoea when facilities for culture are not immediately available, and reports on the performance of a special method (Stuart, 1946) for maintaining the viability of the gonococcus in material which cannot be cultured for 12 to 24 hours after collection from the patient. The application of this method to the diagnosis of *Trichomonas vaginalis* infestations is also discussed.

When adequate bacteriological facilities are available either within a venereal diseases clinic or immediately adjacent, gonococci can be cultivated from clinical material with comparative ease. The need for culture and the advantage of adding this procedure to stained smear examination have been stressed in many recent reports (Sewell, Salchow, and Nelson, 1943 ; Reymann, 1944 ; Eldering and Palser, 1946), but the administrative difficulties have too often proved insuperable. The bacteriological investigation of gonorrhoea requires a trained bacteriologist with specialized and expensive equipment, but the necessary dispersion of clinics in big cities renders this economically impracticable. The transport of unprotected swabs to a central laboratory is feasible, but this must be done very quickly—within half an hour (Muir and Ritchie, 1937). Since work in clinics is often done in the evening and may last three or four hours, this would necessitate numerous journeys between the clinic and the laboratory and an enlarged laboratory staff—at increased cost. Other methods have been suggested, such as the transport of material in dry ice (Wortmann *et al.*, 1941), in vacuum flasks (Christiansen and Becker, 1938), or surrounded by hot-water bottles (Malcolm and Dolman, 1939). Such methods are difficult to apply except under special circumstances, and most recent authors suggest the use of slopes of solid media or tubes of fluid media inoculated in the clinic and transported to the laboratory as soon as possible (Pitts, 1940 ; Carpenter, 1943 ; Peizer and Steffen, 1943). Reymann, however, points out that a major defect of these methods is the overgrowth of contaminating bacteria which frequently occurs. The inoculation of culture plates in the clinic and their primary incubation there before transport to the laboratory is obviously equivalent to direct culture, but few clinicians have the time and experience to carry out efficiently the inoculation and incubation of culture media, and few of the simpler transport methods yield successful results if the swabs are delayed more than eight hours before culture (Carpenter, 1943 ; Morton and Lebermann, 1944).

In Glasgow we were faced with this problem of dispersed clinics in which a large amount of work was done in the evenings and from which material could rarely be brought to the central laboratory in less than 18 hours. The clinics were working under great pressure and the attending clinicians could not undertake any extra bacteriological work. Yet, particularly in the diagnosis and control of female

gonorrhoea, the need for bacteriological culture facilities was felt to be urgent. In consequence certain bacteriological investigations were carried out. These determined that oxidation, and not temperature or drying, was the basic factor responsible for the rapid death of gonococci, and confirmed that the multiplication of other bacteria at the expense of gonococci was a major disadvantage of most transport methods in which swabs were placed in a nutrient medium. The use of crystal violet (Cox, McDermott, and Mueller, 1942) and tyrothrycin (Stokinger, Ackerman, and Carpenter, 1943) as selective bacteriostatic agents was found to be completely unreliable, since gonococci themselves were often susceptible to the lowest effective concentration, as Reymann has pointed out. Therefore a non-nutrient fluid transport medium was prepared in small convenient screw-capped bottles into which swabs could be placed direct at the clinics. Anaerobiosis was maintained by a suitable reducing agent. After considerable experimental work, which is outlined elsewhere by Stuart (1946), a suitable medium was evolved and was immediately tried in clinical practice. Early results showed that gonococci on the specially prepared swabs would occasionally remain viable in the transport bottles for as long as 15 days and that they were regularly viable after 24 hours. This made a more extended investigation desirable, the nature and results of which are given below.

Methods

Medium.—A quantity of 200 ml. was found convenient to prepare at one time; 190 ml. of previously autoclaved 0.3% fibre agar in distilled water was melted and 0.2 ml. of thioglycollic acid (B.D.H.) added. Sufficient N/1 NaOH was incorporated to bring the mixture to approximately *p*H 7.2, and then 10 ml. of 20% sodium glycerophosphate in distilled water was added, along with 2 ml. of a similar 1% solution of calcium chloride. The medium was mixed thoroughly, and while still hot was titrated to *p*H 7.4 with N/1 NaOH. Then 0.4 ml. of methylene blue (0.1% in water) was added to give a final concentration of 1 in 500,000, and the medium was replaced in the steamer for a few minutes before distribution to ¼-oz. screw-cap "bijou" bottles, about 7 ml. in each. Bottles with well-fitting screw caps and sound rubber washers were selected previously. The bottles with the medium were sterilized for one hour in the steamer. On removal one or two bottles were used to fill up the remainder, so that each bottle contained a quantity of medium sufficient to ensure its being absolutely full when the swab was added, with the ultimate object of excluding as much air as possible. The caps were screwed down firmly and the bottles were kept for at least 24 hours before issue. If oxidation was then evident in any bottle, shown by the blue colour of oxidized methylene blue, that bottle was rejected.

Clinical Outfit.—This consisted of one of the above bottles and a sterile wooden applicator tipped with an absorbent cotton-wool swab in a plugged tube. The swab and stick required special preparation, since both tended to be acid before treatment. For this reason sticks and cotton-wool were first boiled in Sorensen's phosphate buffer solution *p*H 7.4, then dried in the oven before being prepared for use.

Specimen-taking.—After superficial cleansing of the vulva the urethra was massaged to express any exudate and specimens were taken on swabs for smear and culture. A bivalve speculum was used to dilate the vaginal canal, the vault was mopped with dry sterile cotton-wool, and swabs were taken direct from the cervix. The swabs for culture were placed immediately in the transport bottles so that they reached about three-quarters down the medium. The sticks were then broken off or cut with scissors and the caps screwed down firmly.

Culture.—The meat-extract agar described by McLeod *et al.* (1934) was used as a basis for all media, usually one unheated and one heated horse-blood-agar plate being used for each specimen. Various methods of inoculating the culture plates were employed. The swab was extracted from the bottle with small artery forceps and was either applied direct to a quadrant of each plate or was rubbed in 0.2 ml. of peptone water in a small tube. The second method allowed the dispersion of a more regular inoculum by a Pasteur pipette. One drop of the peptone-water suspension on the unheated blood-agar plate and two drops on the chocolate plate were found to be generally suitable amounts. The initial inoculum was then spread over successive quadrants of the plate with a platinum wire or a glass spreader. Culture plates were incubated at 36° C. in biscuit tins containing 10% CO_2, produced by a calculated weight of marble dropped into a small container of 20% HCl within the tin just before the lid was put on. Later, tablets containing the correct amount of sodium bicarbonate were found more convenient in use.

Reports.—Cultures were incubated for 48 hours before report, but often gonococci could be identified in 24 hours. A positive report was based on colony morphology, a positive oxidase test, and typical microscopical findings. Fermentation tests were carried out regularly to control early results, but with increasing experience were found necessary only in doubtful cases.

Results

Gonococci

In the majority of instances smear preparations were examined in the clinic by workers experienced in this type of microscopical diagnosis. In assessing the value of the transport culture method these results were accepted, except that "doubtful" findings were disregarded as being of no clinical value. Table I gives the results of smear and culture

TABLE I.—*Comparison of Smears and Cultures from Adults (844 specimens)*

Smear: / Culture:	+ / +		+ / 0		0 / +		0 / 0		+ / c		0 / c	
	M	F	M	F	M	F	M	F	M	F	M	F
Suspects	44	53	1	13	0	29	9	241	0	0	0	2
Chronic and test for cure	14	2	3	7	7	9	55	349	0	2	2	2
Total ..	113		24		45		654		2		6.	

c = culture contaminated by spreading organism. + = positive. 0 = negative.

in a series of 844 separate specimens from male and female adults.

It can be seen that cultural investigation added over 32% more positives to the number detected by smear examination alone, and diagnosed 86% of the total positives compared with 76% by smear examination. The success or failure of culture was probably determined by many factors, of which minor variation in the quality of the culture media was perhaps most important, and delay in culture least. Table II shows the influence of this time factor, 12

TABLE II.—*Effect of Delay in Culturing Specimens*

Smear: / Culture:	+ / +	+ / 0	0 / +	0 / c
< 12 hours	11	0	5	0
> 12 hours	102	24	40	2

hours being chosen as the mean. The average interval between taking the swab and its culture in one set of specimens was six hours and in the other 18 hours. There is no significant difference between the results, whether the specimens were less or more than 12 hours old.

Culture results in 82 specimens from children were superficially not so satisfactory. No acute positive, however, was missed; but 13 "test for cure" specimens out of a total of 16 positives were discovered by smear examination only. The majority of these patients had been under treatment from several months to two years and many showed no clinical manifestation of disease.

The relative efficiency of smear and culture was not significantly different in urethral or cervical specimens, but slightly more urethral cultures were positive when smears were negative. In general, urethral cultures were of greater

diagnostic value than cervical cultures. In 32 cases both swabs were positive, but 18 urethral swabs were positive when the corresponding cervical swab was negative, and only eight cervical swabs when the urethral swab was negative.

Trichomonas

During this investigation it was accidentally discovered that *T. vaginalis* remained alive and active in the transport medium. The detection of these organisms was simple. A drop of peptone-water suspension prepared from a swab was placed on a clean slide under a coverslip and examined microscopically with reduced illumination. Frequently the presence of the parasite could be detected with a 2/3-in. (1.7-cm.) objective (× 60) by its active jerking movements, and brisk flagellar movement could be seen regularly with a 1/6-in. (0.4-cm.) objective (× 240). To determine the reliability of this method of examination, 401 consecutive specimens, including a number from males and children, were examined in parallel by the simple wet-film method and after Leishman staining. To make the examination of direct comparative value the wet film was examined first and the result recorded as positive only if distinct movement, either organismal or flagellar, was seen. Then the coverslip was removed carefully, the fluid on the slide concentrated on as small an area as possible and fixed in the usual manner. Thus the same specimen was examined by the two methods. Staining and further examination were carried out independently by another worker with many years' special experience in this type of investigation. In spite of the apparent advantage of the stained film (Table III) it was found that in only two instances were more

TABLE III.—*T. vaginalis : Comparison of Stained Film and Wet Film*

Stained Film: / Wet Film:	+ / +	+ / 0	0 / ±	0 / 0
< 12 hours	16	4	5	42
> 12 hours	65	24	7	238
Total	81	28	12	280

than one or two trichomonads present in the 28 positives not detected by wet film, so in view of the latter's simplicity it was adopted as a routine. In all, 710 consecutive specimens were examined by this method (Table IV). Of 312

TABLE IV.—*Incidence of T. vaginalis*

	Urethra		Cervix (Adults)	Vagina (Children)
	Male	Female		
Positive	2	60	120	2
Negative	39	237	191	59

adult women examined *T. vaginalis* was found in 139. The incidence in patients with gonorrhoea was 20 out of 45, in patients with non-specific leucorrhoea 73 out of 144—in both instances approximately 50%. However, in a series of 123 women examined as a test for cure and in whom no clinical symptoms were manifest 46 were found to be positive—an incidence of more than 37%.

Discussion

The success and simplicity of the above transport method recommend its use in clinical venereal disease practice. The principle that the prevention of oxidation helps to maintain gonococcal viability in transport material has been established by experience. Nevertheless, in common with many other newly established techniques unexpected difficulties have arisen. It has been found that many batches of agar now available are unsuitable, perhaps because of their content of a bacteriostatic or bactericidal substance described by Ley and Mueller (1946). Recent experiments suggest that these difficulties may be circumvented comparatively simply, and it is hoped to publish shortly a description of the amended technique. The difficulty associated with the overgrowth of other bacteria does not arise in the method described, but the discovery of an effective selective bacteriostatic agent would still be of great benefit in culture by allowing a much larger inoculum to be used.

The value of cultural investigation of gonorrhoea is now probably universally accepted. Certainly in female gonorrhoea the difficulties which face the clinical worker dependent solely on the results of smear examinations cannot be overemphasized. Most observers will agree that a smear from an average mixed infection in a female always shows the presence of organisms with some morphological resemblance to gonococci. Many of these are Gram-negative coccobacilli which have often a distinct tendency to coccal morphology in exudates. De Bord (1943) described many of the organisms which may be mistaken for gonococci by simple microscopical examination. *Neisseria* other than gonococci are not uncommon, but in culture their identity is readily established. In the above series such organisms were isolated on three occasions.

Many striking examples of the advantage of culture have been noted in the above investigation. Six successive smears from one woman were negative, yet the first culture taken was positive. In many women known to have been in contact with a case of gonorrhoea no clinical signs were discovered, yet positive cultures were obtained. Coincident with this or soon after, frank clinical evidence of infection appeared in some of the patients. In spite of the numerous successes, however, failures have also been recorded. Some of these are possibly explicable by adventitious factors. A number of patients were found to have been swabbed in error with a weak antiseptic lotion before the specimen was taken. The persistence of this old clinic routine was only discovered late in the investigation, when the patients affected could no longer be traced. Again, specimens for smear examination were always taken first, and this practice may have weighted the scales in favour of smear examination. Nevertheless, we are convinced that a few strains of gonococci are peculiarly difficult to grow. Such strains have been recorded by Lankford *et al.* (1943). Using media similar to those we employed, Weller and Williams (1946) obtained cultures from only 76% of known positives. Media which are supposed to give better results are now being investigated, but it seems unlikely that complete success will be achieved so long as gonococci have to compete on equal terms with more vigorous contaminating bacteria. It is probably the consensus of modern opinion that even the well-established Loeffler's serum for *Corynebacterium diphtheriae* fails in from 5 to 30% of cases, and greater success has been obtained only since the introduction of potassium tellurite, a selective bacteriostatic agent. In the culture of the gonococcus final success awaits the introduction of such an agent. Perhaps some of the new antibiotic substances may be suitable for the purpose, and it is unfortunate that workers in this field so often seem to abandon further investigation of bacteriostatic substances which prove inactive *in vivo*.

At present we believe that smear and culture investigations are complementary and that successful diagnosis and control of gonorrhoea, in females at least, demand the application of both. The difficulty of applying cultural methods to specimens taken from dispersed clinics has been largely resolved by the transport method described, and we hope that this will prove of value to other workers.

The evidence presented in this paper of trichomonad infestation will not increase clinical belief in the pathogenic importance of this parasite. The very high incidence of the organism in the female genital tract without any inflammation or discharge may suggest very legitimately that its presence in inflammatory exudates is coincidental rather than causative. It may also be pointed out that the detection of *Trichomonas* was merely incidental to this investigation and that the specimens were not those generally considered best for the purpose. It is quite possible that in some women vaginal irritation may be caused by *T. vaginalis*, but to ascribe to it the importance it commonly gets because of its frequent presence in leucorrhoea is an example of *post hoc ergo propter hoc* reasoning which cannot be substantiated by the facts at present available. Further investigation of its occurrence in normal women is obviously desirable. The transport method described allows the investigation to be carried out more leisurely and conveniently than has hitherto been regarded possible.

Summary

A method of transporting specimens for the diagnosis of gonorrhoea is described. By its use facilities for culture can be made available to all clinics within a "time distance" of 24 hours from a laboratory.

The method is at the same time applicable to the detection of *T. vaginalis*.

In the above investigation of gonorrhoea 139 positives out of 184 were found by smear examination alone and 158 by culture. The combination of smear and culture discovered 24% more positives than smear examination alone, and culture alone 10% more than smear.

T. vaginalis was found in approximately 50% of women with vaginal discharges and in almost 40% of women in whom no evidence of inflammatory disorder was evident and who were examined as a test for cure of gonorrhoea.

FOOTNOTE.—Since this paper was written an alteration in technique has been found necessary owing to the bactericidal action on *Neisseria* of certain later batches of agar used in preparing the transport medium. This property is apparently the same as that described by Ley and Mueller (1946), and is particularly prominent in the absence of nutrient material which is a feature of the medium described. The inhibitory effect can be neutralized by charcoal (Stuart, 1947), but charcoal cannot be incorporated in the medium without absorbing the methylene-blue reduction indicator. Accordingly, swabs are prepared as described above and then dipped in a 1% water suspension of finely ground charcoal (B.D.H. blood charcoal and "norit" have been found equally suitable) before being dried and sterilized. Results from a year's experience with these charcoal-impregnated swabs are significantly better than those given above, and suggest that even when the agar is apparently free from inhibitor this alteration in technique is desirable.

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THE ROLE OF ABDOMINAL TRAUMA IN ACUTE APPENDICITIS

BY

W. RUTHERFORD BLACK, F.R.C.S.Ed.

Tutor in Surgery, University of Bristol

Abdominal trauma as a causative or contributory factor in the development of acute appendicitis occasionally merits attention, as the symptoms of that condition have appeared very soon after receipt of the injury. Boyd (1947) states that "there is no doubt that a blow on the abdominal wall may occasionally *precipitate an acute attack of appendicitis.*" J. B. Murphy (1908) cites an analysis by von Neumann of 152 cases of acute appendicitis in 10 of which trauma, either from direct injury to the abdomen or from strain during lifting, was a causative factor. Romanis and Mitchiner (1937) observe that "in some cases injury undoubtedly stimulates an attack, but this is rare . . . it is possible that a twist, blow, or strain . . . will cause a concretion to move and completely block the appendix."

The role of trauma as an exciting factor in the production of acute appendicitis assumes importance from the medico-legal aspect when abdominal injury received during employment is advanced to procure compensation in the courts. Quite recently two cases of acute appendicitis have been encountered immediately after abdominal injury. As both occurred in children of school age, where the motive for procuring compensation did not arise, it is of interest to record them.

Case 1

A schoolboy, aged 14, on mounting his bicycle at 9.50 p.m. on Feb. 15, 1948, missed the pedal and fell forward, and the left handlebar struck him forcibly in the centre of the epigastrium. He had momentary upper abdominal pain, but almost immediately mounted his cycle and reached his home at 10.5 p.m. When in bed, about 10.30 p.m., he experienced soreness in the upper abdomen, but fell asleep. He woke about 3.30 a.m. with generalized colicky abdominal pain, and vomited, after which the pain localized in the right iliac fossa. His pain persisted, and he vomited twice more before his admission to hospital at 10 a.m on Feb. 16, twelve hours after the receipt of the injury. He had not had his bowels open since his injury; there was no abnormality of micturition; and there was no previous history of a similar attack.

On examination the temperature was 99.4° F. (37.4° C.), pulse 84, respirations 16. The patient was pale and evidently in pain. His tongue had a light yellow fur, and there was slight fetor oris. The abdominal wall was immobile on respiration, with resistance and tenderness in the centre of the epigastrium above the umbilicus. Tenderness and guarding were greatest in the right lower abdominal quadrant, where "release pain" was also elicited. There was no loss of liver dullness. Rectal examination revealed tenderness maximal towards the right side of the pelvis. The urine contained no abnormal constituents. The blood pressure was 120/90.

A provisional diagnosis of a ruptured hollow viscus, probably upper jejunum, was made, and laparotomy was decided on.

Operation.—Under thiopentone, 0.5 g., nitrous-oxide–ether-and-oxygen anaesthesia, the abdomen was opened through a right paramedian incision, greater in extent above the umbilicus than below. The stomach, duodenum, and duodeno-jejunal junction were normal. There was a very fine frothy exudate