and 0.15 mg. per 100 ml. The Fouchet method was only slightly less sensitive, usually detecting concentrations between 0.15 and 0.20 mg. per 100 ml. The iodine method was always less sensitive than the other tests, and usually over 1 mg. per 100 ml. was needed for a positive result. The sensitivity did not alter with the cause of the bilirubinuria, whether due to obstruction of the bile passages, to infective hepatitis, or to portal or biliary cirrhosis.

These results agree well with those of Sobotka and his co-workers (1953), who found that the lowest concentration of urinary bilirubin giving a colour varied from 0.04 to

TABLE I.—Comparison of the Test Results with the Quantitative Analysis of Urinary Bilirubin

Diagnosis	Undiluted Urine Bilirubin (mg./100 ml.)	Lowest concentration of bilirubin (mg./100 ml.) in diluted urine giving positive test		
		Tablet	Fouchet	Iodine
Obstructive jaundice ..	8.5	0.13	0.27	4.25
Infective hepatitis ..	8.2	0.06	0.06	2.05
" ..	7.6	0.05	0.11	1.90
Cirrhosis ..	6.2	0.10	0.10	3.10
Obstructive jaundice ..	5.8	0.09	0.18	Neg.
Infective hepatitis ..	3.2	0.40	0.40	3.20
" ..	3.0	0.09	0.18	0.75
Obstructive jaundice ..	2.5	0.31	0.62	1.25
Subacute hepatitis ..	2.4	0.15	0.15	1.20
Cirrhosis ..	2.3	0.07	0.14	2.30
Obstructive jaundice ..	1.4	0.17	0.17	Neg.
Infective hepatitis ..	1.1	0.14	0.07	1.1
Obstructive jaundice ..	1.0	0.50	Neg.	Neg.
Cirrhosis ..	1.0	0.12	0.06	0.50
Obstructive jaundice ..	0.9	0.06	0.11	Neg.
Cirrhosis ..	0.9	0.22	Neg.	Neg.
Obstructive jaundice ..	0.7	0.02	0.04	"
Cirrhosis ..	0.13	Neg.	Neg.	"

0.1 mg. per 100 ml. Free and Free (1953) stated that 0.1 mg. of bilirubin per 100 ml. of urine usually gave a positive result. Klatskin and Bungards (1953) found that the first definite colour change was at 0.05 mg. per 100 ml., but 0.9 mg. was needed for a definite positive. These workers found that albumin in the urine would interfere with the sensitivity of the tablet test. This finding could not be confirmed in the present study.

Relation to Serum Bilirubin Level

Simultaneous serum bilirubin estimations and urine tests were performed on 92 occasions. In every instance the serum bilirubin level was greater than 1 mg. per 100 ml. (Table II).

TABLE II.—Comparison of Urinary Test Results with the Simultaneous Serum Bilirubin Concentration

	Serum Bilirubin (mg./100 ml.)		
	1-3.0	3.1-5.9	>6.0
No. of urines tested ..	23	19	50
Tablet positive ..	10	15	49
Fouchet ..	10	14	49
Iodine ..	2	7	47

Clinical icterus is apparent at 2 to 3 mg. of serum bilirubin per 100 ml., and at this level the tablet and Fouchet reactions may or may not be positive while the iodine reaction is usually negative. Even at values of 3 to 6 mg. per 100 ml. all these methods may give negative results. At serum bilirubin levels above 6 mg. per 100 ml. the reactions were usually positive.

The failure to detect bile pigment in the urine at low serum bilirubin levels can be attributed to the small number of patients with early infective hepatitis included in the series. In these subjects bilirubin occurs in the urine at low serum bilirubin levels. Cases of obstructive jaundice with low serum bilirubin values were also few in number. The majority of the patients studied when their serum bilirubin value was low were recovering from infective hepatitis, in which disease bilirubin is known to disappear from the urine in the presence of a raised serum bilirubin level.

For the early detection of bilirubin in the urine in the jaundiced subject the tablet test is at least as good as

Fouchet's method. The iodine method is not sensitive enough to justify its continued routine performance in ward side-rooms. The modification with the mat and Fouchet's reagent but no tablet is superior to the iodine ring method although inferior to the usual Fouchet's method and to the tablet test.

Summary

A new tablet test for urinary bilirubin is described which is specific for bilirubin, and of at least equal sensitivity to the Fouchet test while being quicker and easier to perform. The iodine ring test is of little value as a method of detecting small amounts of bilirubin in the urine.

We wish to thank Mr. J. A. Bunce, of Don S. Momand Ltd., who provided the tablets and test mats for the trial, and Dr. B. H. Billing for the quantitative urinary bilirubin estimations.

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Medical Memoranda

Scrotal Pneumocele Complicating Induction of Artificial Pneumothorax

Although several cases of scrotal pneumocele complicating artificial pneumonoperitoneum have been reported it has not been possible to find any report of this occurring as a complication of artificial pneumothorax treatment. The following case is therefore recorded.

CASE REPORT

A man aged 40 was admitted to the London Hospital Annexe on March 17, 1952, with advanced bilateral pulmonary tuberculosis, and a previous history of a right inguinal herniorrhaphy some 25 years before. After treatment with bed rest and full courses of chemotherapy it was decided to attempt to induce a right artificial pneumothorax, although at the time it was realized that this might not be possible as extensive adhesions were to be expected.

Induction of a right artificial pneumothorax was carried out at 2 p.m. on December 17. The initial intrapleural pressures were -11 and -3 mm. of water, and there was a free rise and fall in the manometer. 350 c.cm. of air was introduced, the final pressures being -11 and 0 mm. of water.

During the course of the induction the patient had an attack of coughing, but did not complain of any difficulty in breathing or of pain, and there was no surgical emphysema at the completion of the induction. Shortly afterwards another bout of coughing began, again with no distress, but this time it was accompanied by the appearance of minimal surgical emphysema around the site of the injection. The cough was settled by the administration of linct. terp. heroin co., 1 dr. (3.5 ml.), and no more surgical emphysema developed.

However, at 9 p.m. another bout of coughing began, accompanied by some slight breathlessness. The patient went to sleep after this, but awoke at 11 p.m. to find that his scrotum was distended but not painful. On examination he was not distressed or dyspnoeic. Other than a small collection in the right axilla, surgical emphysema was minimal down the right side of the trunk and along the line of the right inguinal canal to the right side of the scrotum, which was distended to about 5 by 3 by 2 in. (12.5 by 7.5 by 5 cm.).

The patient was sedated and slept well, but by 10 a.m. the next morning surgical emphysema was extensive in the right axilla and the right side of the chest, pitting up to about 1 in. (2.5 cm.). It was minimal in the neck, but

extended down the right side of the trunk from 2 in. (5 cm.) behind the posterior axillary line forward to the midline and down to about 1 in. below the right inguinal ligament. There was a bilateral rounded swelling of the scrotum measuring some $6\frac{1}{2}$ by $5\frac{1}{2}$ by $4\frac{1}{2}$ in. (16.5 by 13.9 by 11.4 cm.) (see illustration). The swelling was tense, cystic, non-tender, resonant on percussion, and highly translucent. It was irreducible and there was no cough impulse. What was thought to be the most characteristic physical sign was the high-pitched squeak, like that obtained from a rubber balloon, emitted on stroking firmly with the fingers. No crepitus was elicited over the scrotum. The testes were not palpable nor were they revealed by transillumination. Surgical emphysema extended back to the perineal body and was also found along the penis. It should be noted that the scrotum alone contained about three times the volume of air used at the induction. This suggests that the induction was followed by a spontaneous pneumothorax, or that, owing to diffuse pleural fusion, the needle had punctured the lung.

An x-ray film of the chest showed no evidence of air in the pleural cavity or mediastinum, but considerable pool-

ing of air between the muscle layers. The fibres of the pectoralis major muscle were clearly defined owing to infiltration of air between them. X-ray examination of the abdomen showed similar collections of air between the muscle layers, and the right kidney was clearly outlined, proving the presence of air in the retroperitoneal plane. An x-ray film of the scrotum showed the septum clearly defined between collections of air in each scrotal compartment, the testes being pushed well up into the groins.

No treatment was given, as the condition was causing no distress, but the swelling persisted for more than three weeks.

COMMENT

The interest in this case lies in the fact that no reference has been found in the literature to the occurrence of scrotal pneumocele as a complication of pneumothorax treatment. Distension of the scrotum with air has been reported as a sequel to diverticulitis of the colon with perforation (Rankin and Judd, 1922) and as a complication of pelvolithotomy (Counseller and Butsch, 1935). Wynn-Williams (1949) suggests that scrotal pneumocele as a complication of artificial pneumoperitoneum is more common than previously thought. He reviews the literature and finds that ten cases have previously been reported. He adds a case of his own which was further complicated by a strangulated inguinal hernia. In this case a distended processus vaginalis was demonstrated at operation.

Most authors comment on the presence of crepitus in the scrotum, but in the case reported above this was absent and the "balloon" sound provided the most convincing sign of the presence of air in the scrotum. The demonstration of this physical sign to a hitherto mystified group of students immediately evoked the correct diagnosis. Another interesting feature of this case was the early inflation of the scrotum when there was relatively little

surgical emphysema elsewhere. This may be related to the disruption of the tissue planes associated with the right inguinal herniorrhaphy.

I wish to thank Dr. Kenneth Perry for permission to publish this case, and Dr. C. M. Ogilvie for his advice and encouragement.

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Onchocerca Volvulus in a Paratyphoid Abscess

An African girl aged 14 was admitted to the Gold Coast Hospital, Accra, for investigation of pain in the right groin. She was found to have a slightly tender area on the inner side of the right thigh near the origin of the adductor muscles. For four weeks she had an irregular temperature with a varying leucocytosis, whilst the induration slowly progressed to a fluctuant abscess. There was no response to penicillin treatment.

The abscess was incised and yielded about 6 oz. (170 ml.) of pus, which contained fragments of an adult filarial worm. Dr. M. H. Hughes examined the pus and reported that it yielded *Salm. paratyphi C* in pure culture. The worm was thought likely to be *Onchocerca volvulus*, and Professor J. C. C. Buckley kindly confirmed this provisional identification.

In view of the finding of an adult *O. volvulus*, skin smears were examined on a number of occasions, but no microfilariae were detected. The patient made an uninterrupted recovery after evacuation of the abscess, and *Salm. paratyphi C* could not be isolated from her stools. She gave no history of a previous feverish illness which might have been paratyphoid C fever, although this is not an uncommon cause of fever in children in Accra.

COMMENT

Suppuration in onchocerca nodules and the presence of these worms in deep abscesses have not often been recorded in the literature. Roubaud and Jamot (1920) recorded a case of a large subpubic abscess from which at incision 10 entire male and five female worms were obtained. Rodhain (1920) considered suppuration in nodules rare and usually limited by the fibrous capsule. He described two cases of suppuration in superficial nodules, both with superficial ulceration. Chesterman (1932) mentioned that he had seen only one case of abscess formation. Strong *et al.* (1934) also described it as exceptional, and mentioned only one case of its occurrence, in a scalp nodule. Gabathuler and Gabathuler (1947), reporting on onchocerciasis in East Tanganyika, mentioned it as a possible cause of the deep-muscle abscesses seen so frequently there, and described finding an adult female worm in an abscess on a rib of a patient showing multiple muscle abscesses.

The interesting features of the present case are the negative skin tests, absence of nodules, the finding of only one worm, and the unusual nature of the infecting organism. It is also curious that the site should have been the same as that of one of the few previously described cases. It remains to conjecture whether the presence of the worm in the abscess was purely coincidental, or whether, alive or dead, it provided the nidus for the infecting organism.

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