incidence in femoral herniae was 11 males, 25 females, and 8 not stated or not ascertained; and in inguinal herniae it was 10 males, 3 females, and 4 not stated or not ascertained. (4) Perforation of the diverticulum into the hernial sac occurred in four cases, and through the skin (as a faecal fistula) in six cases of femoral hernia; of the six who developed faecal fistula, five survived (83%); of the four who had perforation into the sac none survived. The corresponding figures for inguinal hernia were two perforations into the sac and one through the skin—all three survived.

In addition to inguinal and femoral Littre's herniae, cases have been recorded of Meckel's diverticula in umbilical (Bianchi, 1927), sciatic (Brodnax, 1924), and lumbar (Rodnaev, 1939) herniae.

Discussion

Numerous cases of Meckel's diverticulum lying free in hernial sacs have been described, these being more common in inguinal than in femoral herniae. This is attributed to the fact that the intestinal coils found in a hernia are those possessing the longest mesentery. Anatomically the longest mesentery is possessed by the lower ileum, which is also the site of Meckel's diverticulum when present (Bunts, 1904).

In addition, a host of mixed Littre's herniae are on record. The strangulation of a Meckel's diverticulum (itself not a particularly common occurrence) as the sole content of a hernial sac (true Littre's hernia) is decidedly uncommon.

The prognosis in strangulated Littre's hernia is more favourable than in a strangulated mixed Littre's or even, for that matter, the strangulation of a bubonocoele or femoral hernia; for whereas in the former the faecal stream is unimpeded, in the latter two types there is complete obstruction, and death is inevitable unless the obstruction is relieved by operation, spontaneous reduction of the hernia, or by the formation of an external fistula (Friedman, 1931). In the case of true Littre's hernia, despite the uninterrupted passage of bowel content, perforation of the strangulated bowel does occur, probably in those cases in which feculent material, entrapped distal to the point of strangulation, leads to distension and necrosis of the blind diverticulum.

In the reported cases perforation occurred in 10 femoral herniae and 3 inguinal herniae. In the former, only those patients who developed a spontaneous faecal fistula survived (five out of six); all four of those who had perforations into the sac, without the safety-valve mechanism of a faecal fistula, died. In the three cases of perforated Littre's inguinal hernia (two into the sac; one externally as a fistula) there was no mortality.

In the case described above the patient had minimal systemic effects, and was sent into hospital with a provisional diagnosis of an indolent inguinal abscess, this being very similar to the case described by Weinstein (1938). After further appraisal in hospital a strangulated Richter's hernia was diagnosed; this is the common pre-operative misdiagnosis. That this old lady survived the mishap which befell the congenital anomaly that she had borne for 82 years must, I think, be attributed to the fact that she developed a spontaneous faecal fistula, which saved her from peritonitis and toxic absorption.

Summary

Littre's hernia is defined, with reference to his original description.

A case of Littre's hernia with spontaneous faecal fistula formation (the first recorded case of fistula in an inguinal hernia) is reported.

Cases of Littre's inguinal and femoral herniae (with and without faecal fistula formation) are reviewed.

Mention is made of the complications befalling Meckel's diverticula, and of the need for removing those diverticula incidentally found at laparotomy.

I thank Mr. G. C. Sawyer for permission to treat this patient and report the case. To him and to Mr. J. T. Rowling I am

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TROPICAL HAZARDS ASSOCIATED WITH THE USE OF PENTACHLOROPHENOL

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Nine deaths within a period of 18 months have occurred among workers in sawmills where pentachlorophenol ("santophen 20"), or its sodium salt, is used as a wood preservative. All these deaths were preceded by a peculiar illness which proved rapidly fatal, and, as details of intoxication do not appear to be widely publicized or well known, it was felt that this chemical is, in fact, more toxic than previously thought.

Properties and Local Use

The sodium salt (sodium pentachlorophenate; "santobrite") is readily soluble in water, stable, practically odourless, non-corrosive to metals, and toxic to a very wide range of micro-organisms, including fungi, yeasts, and bacteria. It is used in industry as a preservative, fungicide, and disinfectant, and in Sarawak is used mainly to prevent sap-stain in timber. Pentachlorophenol is not a scheduled poison and is often described as "relatively non-toxic." Although Edson (1955) listed it as "comparatively safe," he stated that as it was of recent introduction its comparative safety was provisional.

For the prevention of sap-stain it is used as a solution of between 1½ and 2% in water, and, on occasion, anhydrous sodium carbonate or borax is added to prevent acidic timbers causing precipitation of the pentachlorophenol with subsequent deterioration of its powers as a preservative of timber. During the rainy season, when sap-stain is especially prevalent, the concentration used is higher (2%) than during the dry season (1½%). The dip-tank is usually made of wood or metal, and is fitted with an inclined draining-board on to which the wood is pulled after being immersed in the solution in the tank. Two methods are in use: a mechanical method, where the wood is carried by an endless chain; and hand-

dipping, where the wood is lifted out by hand or by a wire hook. The wood rests approximately 30 to 60 seconds on the draining-board and is then lifted by hand on to trolleys and taken away for stacking. The wood is usually dripping wet with the solution and is often handled by men not wearing any protective clothing.

Clinical Details

The clinical details are given in Tables I and II. Sweating was pronounced in all cases. The most striking fact is the rapidity of the illness, with death ensuing within nine hours (in six cases) and within 16 hours in two (Nos. 2 and 4). In Case 9 the patient would, I think, have died within 12 hours had it not been for the most strenuous efforts to combat his hyperpyrexia

and dehydration, which served to prolong his life for 25 hours from the onset of symptoms.

Hyperpyrexia, gross dyspnoea, and prolific sweating were all noted, though abdominal symptoms were not such a marked feature as they were in the cases recorded in Australia by Gordon (1956). This might be explained by the local tolerance to abdominal symptoms, which are all too common a feature of the everyday life of these patients.

Terminal spasm was noticed in all cases, and was severe enough to be remarked on by relatives and lay attendants.

Case 9 is described in detail, as the signs, symptoms, and progress would appear to be characteristic of poisoning by pentachlorophenol.

TABLE I

Case No.	Age	Date	Hyperpyrexia		Abdominal Pain of Nausea	Dyspnoea	Spasm	Hours from Onset to Death
			°F.	°C.				
1	19	15/10/53	104	40	Marked	Slight	Marked	3
2	20	26/2/54	105	40.6	Moderate	Marked	"	13
3	22	16/3/54	102	38.9	"	Slight	"	3
4	30	14/5/54	104	40	Slight	Marked	"	16
5	32	20/8/54	106	41.1	"	"	"	6
6	25	10/10/54	101	38.3	None	"	Unknown	9
7	17	12/3/55	101	38.3	Marked	"	"	9
8	48	12/4/55	104	40	"	Slight	"	7
9	22	15/7/55	108	42.2	Slight	Marked	"	25

TABLE II.—Details of Cases

Case No.	Post-mortem Findings	Chemical Analysis		General Case Details
		Urine	Organs	
1	Inflamed gastric mucosa. ? Contamination by oral route	Not done	Not done	Had worked for 21 days on dip-tank. No gloves or protective clothing worn. Friends said he wiped his hands on paper before eating, but rarely washed
2	Inflamed gastric mucosa. ? Contamination by oral route	"	Nil found	Worked for 21 days on dip-tank. No gloves or protective clothing worn. Was saving money and ate only one meal of rice a day
3	Nil abnormal discovered	"	"	Worked for 14 days on dip-tank. No gloves or protective clothing worn. Did not change clothes or wash when he finished work
4	Congestion of lungs noted. ? Inhalation contamination	"	"	Worked for 30 days on dip-tank. No gloves or protective clothing worn. Never washed or changed clothing when he finished work. Chain smoked cigarettes (home-made) while working
5	Nil abnormal discovered	"	"	Worked for 5 days on dip-tank. No gloves or protective clothing worn. Never washed or changed clothing when he finished work. Ate only one rice meal at 10 a.m. daily. Said he could not afford fish or meat
6	" "	"	"	Worked for 7 days on dip-tank. Wore only rubber gloves and cotton shorts. Ate three meals a day but washed only at midday
7	" "	Nil found	"	Worked for 7 days on dip-tank. No gloves or protective clothing worn. Jumped out of boat on way to hospital as he was hyperpyrexial and thought he was going to die
8	Acute gastritis noted. ? Contamination by oral route	"	"	Worked for 8 days on dip-tank. No gloves or protective clothing worn
9	Acute oedema of brain and lungs. ? Inhalation contamination	P.C.P. 160 p.p.m.	"	Worked for 3 days on dip-tank. Wore only rubber gloves and cotton shorts. Ate rice only twice a day as he was saving money. Rarely washed

Case 9

A male Sea Dyak aged 22, weight 115 lb. (52.2 kg.), worked at the dip-tank, sorting timber on the draining-board, for three days preceding his illness. He first complained of feeling unwell at 3 p.m. and of weakness in the legs; he vomited twice and had frequency of micturition. He then began to sweat copiously and became dyspnoeic. He was put in a boat and sent up-river to hospital by the hospital assistant, who was worried about the patient's condition, which appeared to be deteriorating rapidly. He arrived at hospital at 1 o'clock the following morning.

On examination he was conscious but could not give much in the way of a history and did not complain of anything very specific.

His temperature was 101.2° F. (38.4° C.), pulse 120, and respirations 35. He was sweating mildly, and clinical examination revealed very little that was abnormal, the main findings being considerable respiratory distress with respirations proceeding to Cheyne-Stokes type. The blood pressure was 75/50. The triceps-jerk in both arms and extensor plantar reflexes (bilateral) were absent.

An intravenous transfusion of glucose-saline and penicillin, 1 mega unit, was given prophylactically as he became comatose. He rapidly became hyperpyrexial in spite of the most strenuous efforts at sponging, fans, etc., and the rectal temperature was 105° F. (40.6° C.) 10 hours after admission. His coma deepened and he died 15 hours after admission without regaining consciousness. Terminally he had marked spasm of all his limbs and his rectal temperature was 108° F. (42.2° C.). Investigations gave the following results: Blood film for malaria parasites, negative; total white cell count, 13,870/c.mm.; red-cell count, 4,010,000/c.mm.; haemoglobin, 74% (Haldane); urine, trace of albumin; cerebrospinal fluid, normal pressure, N.A.D.

Post-mortem Examination.—Macroscopically the only abnormal findings were in the lungs, which were a bright red on section and were congested, but there was no evidence of pneumonia or infection. The spleen was chronically enlarged. Analysis of urine showed pentachlorophenol 160 ± 10 p.p.m. Histological report:—Brain: "Marked oedema; no cellular infiltration in the meninges or around the capillaries; nerve cells normal; no interstitial haemorrhage; no evidence of meningitis or encephalitis." Liver: "Architecture intact; no zonal necrosis or necrobiosis; slight fatty change." Lungs: "Marked oedema; no evidence of pneumonitis."

Treatment

The treatment of pentachlorophenol poisoning is very unsatisfactory and is largely symptomatic, the main points being to combat the hyperpyrexia, to replace the electrolytes, and to add glucose to replace the carbohydrate destroyed by pentachlorophenol's raising of the basal metabolic rate. Cortisone and chlorpromazine would theoretically be of benefit, but there is little clinical evidence to support this, though they are undoubtedly worth a trial.

Preventive measures, if rigorously applied, would seem to be the only answer at present, but they are very difficult to apply when dealing with superstitious and illiterate peoples. The diagnosis would appear to rest on awareness of the condition, together with the characteristic physical signs. Chemical analysis of organs or urine is extremely difficult and would often seem to be negative unless performed by laboratories well versed in the procedure.

Discussion

From the clinical details and the analysis of urine there would seem little doubt that the nine patients died of intoxication with pentachlorophenol. Lack of analytical evidence in Cases 1 to 7 can be partly explained by the fact that the analyses were performed in a small laboratory by a staff that did not have the facilities or the requisite knowledge to use an approved method for the estimation of pentachlorophenol.

The manufacturers (Monsanto Chemical Company, 1951) list the hazards of pentachlorophenol as being confined to irritation of the mucous membranes, sneezing, and contact dermatitis of exposed areas of skin, but various observers have noted toxic effects such as peripheral neuritis. Campbell (1952) described several cases of polyneuritis in men and women who had used a preparation for treating woodworm which contained pentachlorophenol.

In Germany peripheral neuritis, mucosal irritation of the upper respiratory tract, and acne were described by Baader and Bauer (1951).

Animal experiments, however, gave the impression that when lethal doses were administered the symptoms were extremely rapid in onset and included fever and toxæmia (Carswell and Nason, 1938), while Brune *et al.* (1954) described the hyperthermia and raised metabolic rate in animals who were poisoned with pentachlorophenol. Truhaut *et al.* (1952b) noted this also, and described two fatal cases (Truhaut *et al.*, 1952a) in France in which the clinical picture was one of sudden rise in temperature to great heights, profuse sweating, suffocation, muscular contraction, with death supervening in less than 24 hours.

Nomura (1953), in Japan, described a fatal case and two non-fatal cases, and it was noted that the weather was very hot at the time. Profuse perspiration was again a marked symptom.

Gordon (1956), in Australia, has described nine cases, of which five proved fatal. In eight of these sweating and fever were noted, and in two of the fatal cases there was marked spasm. The deaths were all within 30 hours of the onset of symptoms. Only in the last case did analysis reveal the presence of pentachlorophenol.

Edson (personal communication) has expressed the view that pentachlorophenol, like dinitrophenol and dinitroresol, causes a radical uncoupling of oxidation and phosphorylation cycles in the tissues, thus producing a marked increase in basal metabolic rate with all the effects of heat accumulation.

Local Factors

Sarawak has a humid tropical climate, the temperature rarely falling below 70° F. (21.1° C.) or rising above 90° F. (32.2° C.), and with an annual rainfall of 150 in. (380 cm.). The sawmills are mainly situated down-river between 60 and 90 miles (96 and 145 km.) away from the nearest hospital or doctor. Transport is almost entirely by small boats, powered by outboard motors, and, owing to the vast size of the rivers, and the driftwood on them, travelling is limited to the hours of daylight. An unexplained feature of the illness has been its predilection for the true native races (Dyak, Kayan, etc.) rather than the Chinese or Malays, even though there are as many, if not more, of the latter working on the same job. In every instance the Dyaks involved have been men from "up-river" who had come down to the coastal areas as seasonal workers. As physical types they are not very impressive—height around 5 ft. 4 in.

(162 cm.), weight 100 to 110 lb. (45.4 to 50 kg.), and mostly suffering from mixed worm infestations (*Ancylostoma duodenale* and *Ascaris*) and malaria. Their diet is in almost every case a straight rice diet, with little or no protein foods. They are a highly superstitious people given to having dreams and being talked into sickness.

The normal clothing worn by workers in Sarawak consists of only a pair of cotton shorts, and it is likely that gross contamination occurred, especially as in the early days of the use of pentachlorophenol few workers wore rubber gloves, aprons, or boots. Washing rarely involves the use of soap, and normally consists of immersion (wearing the shorts) in one of the large rivers that abound here. In addition, owing to poor supervision, the strength of the solution in the dip-tank rises to unknown values because of the addition of fresh stock solution at periodic intervals without the prior removal of the sludge from the bottom of the tank. A further hazard is due to the fact that Dyaks and Kayans eat their food with their hands, which are apt to be grossly contaminated. Chinese who work in the same conditions, wearing similar clothes, appeared to be immune from the toxic effects, probably because of their better physique, superior diet, and greater care in attending to personal cleanliness.

An interesting sidelight on personal immunity is provided by an Australian overseer of very powerful physique, who, to convince the Dyaks that the solution was not a poison, drank a glass of the 2% solution from the tank. He is reported to have stated that, apart from a severe hangover, he was unaffected.

Since these deaths, strict precautions have been insisted on; these include the prohibition of employment of natives on the dip-tank, rotation of workers so that no one works more than 14 days on the tank, the wearing of rubber gloves, aprons, and boots, the provision of washing facilities next to the tank so that frequent washing can take place, and the reduction of the strength of the solution used to a maximum of 2% (borax being added to keep the solution alkaline when used with acidic timbers). In addition, workers are required to drink a pint of milk a day.

As a result of these measures no deaths or serious cases have been reported in the past 18 months.

Summary

Nine cases of unusual illness are recorded, and, in one, pentachlorophenol was found in high concentration in the urine. The illnesses were characterized by signs of a raised basal metabolic rate, and it is suggested that they were due to poisoning with pentachlorophenol.

The difficulty of accurate diagnosis at the time, owing to lack of any simple specific test, and the need for chemical analysis to be carried out at specialized centres, is stressed. Post-mortem macroscopic and microscopical findings have not so far revealed any diagnostic lesions.

It is also suggested that the problem may well be magnified in tropical countries where workers live on a simple rice diet and may have some racial susceptibility.

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