Thus the results of suture were related less to the appearance of the wound than to the presence of pyogenic bacteria. This does not mean that a bacteriological examination of the wound should be carried out before suture is performed. On the contrary, the surgeon is encouraged to suture wounds (in the presence of penicillin) whether they appear clean or dirty. The significance of these findings is to confirm the importance of pyogenic bacteria in the wound at the time of arrival at the base hospital, and thereby to emphasize the value of the control of infection by early operation at the C.C.S., by the use of penicillin-sulphathiazole powder as a bacteriostatic at the forward operation, and by avoidance of dressing of the wound between forward and rear surgeons.

Influence of Resistant Strains of *Staph. pyogenes aureus* on Suture

All strains of *Staph. pyogenes aureus* were examined for the property of resistance to penicillin. Of the strains 20% were resistant to the concentration of penicillin that is produced by parenteral therapy (1/10 unit per c.cm.), but only one-half of these strains grew in 10 units of penicillin per c.cm., and few grew in broth containing 50 units per c.cm. Thus while 20% of strains of *Staph. pyogenes aureus* could fully resist the concentration of penicillin that obtains in parenteral therapy, many of these strains could be influenced by the increased concentrations that local therapy might provide.

It will be recalled that of the 614 clean wounds 190 were infected. Among these 190 strains of *Staph. pyogenes aureus* 33 were "resistant." Suture of the 33 wounds, accompanied by the local use of penicillin, was followed by the same standard of union as was the suture of clean wounds infected with "sensitive" strains.

The high concentration of penicillin that is obtained by local penicillin therapy has been shown to be of advantage in some situations—e.g., in the pleural cavity (d'Abreu *et al.*, 1944) and in compound fractures (Bentley *et al.*, 1944). These present results of suture indicate that it is also of value in dealing with strains of staphylococci possessing some degree of resistance to the drug.

Summary

In an investigation of 1,000 wounds during the battle for the Gothic Line the organism of initial sepsis was found to be *Staph. pyogenes aureus*. *Str. pyogenes* (haemolytic streptococcus) was rarely found.

The incidence of infection in wounds before operation at the C.C.S. was about 51%.

In wounds undisturbed during transit, and treated at the C.C.S. by operation alone, 49% were infected and 23% were septic; by operation and sulphanilamide powder, 43% and 11%; by operation and penicillin-sulphathiazole powder, 25% and 7%, when examined in the base hospital 5 to 10 days later. Thus operation alone did not completely remove infection from a recent wound. Its effect was to leave the wound in the best possible condition for dealing with the infection that remained. Sulphanilamide applied locally had a bacteriostatic effect; for although the infecting bacteria persisted, their activity was depressed, so that the incidence of sepsis was reduced. Penicillin-sulphathiazole powder similarly applied was more effective; for its use was followed by the destruction of the infecting cocci in about one-half of the infected wounds, with an equally low incidence of sepsis.

Wounds operated upon at the C.C.S. in under 12 hours had a lower incidence of infection than those operated upon between 12 and 24 hours, in all the chemotherapy groups. The length of time between wounding and arrival at the base hospital was found to make no significant difference in the infection rate.

Wounds that had been re-dressed between C.C.S. and base hospital had a higher incidence of infection than had those that had not been disturbed.

The importance of control of infection by operation and chemotherapy at the C.C.S. is illustrated by the results of suture. The presence of pyogenic organisms in the wound at the time suture was performed had an adverse influence on the result obtained. Of wounds uninfected with these organisms 80 to 85% obtained Grade I union, whether appearing clean or dirty; whereas wounds that were infected, even if appearing clean, showed a lower rate of success.

The presence in wounds of staphylococci possessing some measure of resistance to penicillin did not influence the results of suture when penicillin was employed locally in the wound.

APPENDIX

TABLE A.—Results of Suture of 614 Clean Wounds in Relation to Infection

Condition	Total No.	Degree of Success of Suture		
		No. Achieving Grade I Union	No. Achieving Grade II Union	No. Achieving Grade III Union
Infected	190	118 (62%)	37 (20%)	35 (18%)
Non-infected	424	362 (85%)	33 (8%)	29 (7%)

TABLE B.—Results of Suture of 101 Dirty Wounds in Relation to Infection

Condition	Total No.	Degree of Success of Suture		
		No. Achieving Grade I Union	No. Achieving Grade II Union	No. Achieving Grade III Union
Infected	52	19 (37%)	9 (17%)	24 (46%)
Non-infected	49	39 (80%)	9 (18%)	1 (2%)

Grade I union = 85% union or better. Grade II union = 70 to 85% union. Grade III union = Under 70% union.

The data on which this paper is based are taken from a report to the Director of Pathology, War Office, by Thomson and Bentley (1944). We are grateful to Major-Gen. L. T. Poole, D.S.O., M.C., for permission to publish from the War Office report.

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BLAST INJURY TO THE LUNGS CLINICAL AND RADIOLOGICAL FINDINGS AND THEIR RELATION TO CERTAIN SYMPTOMS

BY

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(From a War Hospital)

The effects of explosive blast on the lungs have been studied by Zuckerman (1940) in animals, and clinical and post-mortem findings during the present war, recorded by a number of observers, correspond in the main with those found experimentally. The lesion as it affects the lungs is haemorrhage due to capillary rupture, or possibly diapedesis (Hadfield, 1940-1). According to their severity, Zuckerman has classified the lesions as: (1) a few small haemorrhages on surfaces of lungs; (2) patchy haemorrhages throughout the lungs; (3) complete hepatization of the lungs by haemorrhages. His explanation that the lesions are produced by the wave of positive pressure acting directly on the chest wall would appear to be generally accepted and is convincingly supported by his work. The general clinical picture is definite enough in the groups of cases reported, but both individual symptoms, such as haemoptysis, and radiological evidence of blast injury have a varied incidence.

The Cases

Among the large number of chest injuries, penetrating and non-penetrating, admitted to this hospital 21 appeared to have been caused by blast, and were unaccompanied by additional trauma. No case has been included in which fractured ribs might account for damage to the lung or pleura or in which there was a history of burial by debris together with bruising of the chest wall. A certain amount of selection was inevitable, as only patients fit to travel reached this hospital, the interval between injury and arrival being on the whole proportionate to the severity of the condition. Only one of the cases was seen here earlier than three days after wounding; the majority arrived three to five days and several as long as 10 to 14 days after. It was thus possible to observe cases at different intervals after injury and watch their progress for a few days before sending them on to base hospitals.

The explosive sources were hand-grenades, mortar bombs, land mines, aerial bombs, and in two cases flying bombs.

Although unconsciousness occurred at the time of injury in the majority, the accounts of the positions of the patients in relation to the explosions, the type of bomb, and in many cases the distance from the explosion were surprisingly detailed. With few exceptions the blast seemed to have been sustained chiefly by the chest, and, conversely, cases of abdominal blast—not included in this series—were noticeably free from pulmonary symptoms.

Symptoms

The attitude of mind of these patients was strikingly calm, contrasted with the anxiety and over-reaction shown by many

to describe their sensations after being exposed to blast, and in these cases rapid wheezing respirations, coughing of frothy blood-stained sputum, and sometimes cyanosis were recorded.

Pain was a constant feature, but its duration varied. Two types occurred, sometimes separately, sometimes together: (1) retrosternal pain, constant or intermittent, the latter often relieved by coughing up mucus or blood; (2) muscular pain, accompanied by tenderness, occurring most commonly in the intercostal muscles and occasionally in the upper abdomen and muscle masses of the back. In some cases the pain was severe, with extreme tenderness a week or more after injury, limiting

Table showing Inverse Relation of Haemoptysis to Incidence of Massive Haemorrhage as revealed by Radiographs

Case	Explosive Source; Position	Time Unconscious	Pain	Cough	Haemoptysis	Signs in Chest	X-Ray Findings in Chest
1	Aerial bomb; 50 yards	0	21 days; retrosternal	21 days	1st-12th days; intermittent	Nil 2nd, 5th, 7th-21st days	Nil 2nd, 6th, 12th, 15th days
2	Prone Mortar bomb; 3 feet	8 hours	5 days retrosternal; 10 days upper abdom.	11 days; blood	1st-11th days; intermittent	General rhonchi 1st-3rd days	Nil 1st, 2nd, 3rd, 9th, 10th, 11th days
3	Facing Aerial bomb; 30 yards	0	5 days; retrosternal	8 days mucoid sputum	3rd-10th days; intermittent	Cyanosis, hyperexpansion and general rhonchi 1st day; nil 2nd day or later	Nil 2nd, 6th, 9th days
4	Facing Land mine; 4 yards	5 mins.	3 days; right chest	5 days; mucoid sputum	4th-9th days; daily	Nil 1st, 3rd, 5th, 9th days	Nil 4th, 7th days
5	Left side Land mine; "close"	0	6 days retrosternal and back	5 days; bloody sputum	1st-5th days	Nil 1st, 2nd, 4th, 7th days	Nil 6th, 9th days
6	Supine Mortar bomb; 5 yards	5 hours	10 days; whole chest	5 days; blood	1st-5th days; daily	Generalized rhonchi 1st day; nil 3rd, 5th, 7th days	Nil 1st, 3rd, 8th days
7	Facing Mortar bomb?	3 hours	7 days; whole chest, left arm	3 days; blood	1st-3rd days; daily	Generalized rhonchi 1st day; nil 3rd, 5th, 7th days	Nil 1st, 3rd, 5th days
8	? Mortar bomb; 10 yards	5 hours	3 days; upper abdom., left back	3 days; dry	3rd day	Nil 1st, 4th, 6th days	Nil 4th day
9	? Grenade; 3 yards	Few mins.	5 days; right chest	3 days; frothy sputum	1st day	Nil 4th, 6th days	Nil 4th day
10	Right side Grenade; contact	"Short time"	7 days; left chest and arm	7 days; mucoid sputum	1st-4th days	Generalized rhonchi 1st day	Nil 1st day; right interlobar fluid 3rd day
11	Left side Mortar bomb?	0	8 days; left chest	1 day; bloody sputum	1st day for 6 hours	Nil 1st, 4th days	Increased density left lower zone 4th day
12	Right side Aerial bomb; 25 yards	0	4 days; left chest	5 days; mucoid sputum	1st day	Cyanosis, rapid breathing, no signs in chest, 1st day; nil 4th, 6th, 8th days	Opacities both midzones 4th day; nil 8th day
13	Prone Aerial bomb? Back to	Few mins.	2 days; retrosternal	1 day; blood	1st day	Generalized rhonchi 1st day; dullness and diminished B.S. at left base 5th day	Opacity left lower zone 5th day; opacity clearing 8th day
14	? Aerial bomb?	? hours	2 days; right chest	1 day	1st day	Dullness and diminished B.S. at right base 1st day; diminished B.S. and creps. at right base 13th day	Heavy opacity right lower zone, small opacity left midzone, 3rd day; clearing on right, left side clear, on 6th day; nil 12th day
15	? Flying bomb?	0	10 days; whole chest	Chronic bronchitic	0	Left haemothorax 3rd day; aspirated	Left haemothorax; clear by 24th day
16	Shell; 20 yards	0	15 days; left chest	10 days; dry	1st day	Left haemothorax 2nd day; consolidation left base 12th day; clear 23rd day	Left haemothorax 2nd day; consolidation 13th day; pleural thickening 22nd day
17	Back to Mortar bomb; close	Few mins.	7 days; left chest	3 days; dry	0	Nil 3rd day; dullness left base 14th day	Nil 3rd day; opacity left base 14th day; almost clear 17th day
18	In trench Flying bomb; 20 yards	0	4 days; retrosternal and back	3 days; dry	0	Nil 1st and 2nd days; dullness, diminished B.S., and creps. right base 3rd day; nil 4th day	Nil 2nd and 4th days
19	Back to Mortar bomb; 3 yards	3 hours	14 days; retrosternal, left chest	0	0	Nil 1st day; dullness and diminished B.S. left base 3rd day; nil 8th day	Opacity left base 3rd day; cleared 8th day
20	Left side Aerial bomb? Prone	6 hours	14 days; left chest, back, upper abdom.	0	0	Generalized rhonchi 1st day; consolidation right base 4th day; resolving consolidation left base 14th day	Bilateral midzone opacities right > left, 4th day; opacity left base 14th day
21	Mortar bomb; 3 yards Crouching	0	10 days; upper back	0	0	Cyanosis, scattered creps. both lungs 1st and 2nd days; dullness and diminished B.S. at left base 9th day	Increased density left lower zone 9th day; nil 11th day

of those with penetrating wounds; perhaps they took heart of grace from their immunity to the repeated and sometimes fruitless needling suffered by their fellows. Over half the patients (12) were unconscious for a few minutes to several hours after injury. No abnormal physical signs in the central nervous system were recorded, and in no case was lumbar puncture performed. None of these patients complained of subsequent headache.

Dyspnoea.—This symptom was experienced by all, lasting from a few hours to several days after injury, but was not persistent. Painful respiration, however, in patients with muscular tenderness led to discomfort in transport and lasted from ten days to three weeks. "Tightness" and a "blown-up feeling" were expressions unhumorously used by many patients

respiratory movement. Where the blast had been unilateral the upper-arm muscles on the injured side were apt to be affected.

Cough.—All but two cases suffered from cough; both these patients showed radiological evidence of pulmonary haemorrhage but emphatically denied cough as a symptom, nor did it occur while they were in this hospital. Coughing of frothy and sometimes blood-stained sputum for several hours after injury was common. After this the cough might become dry, or mucoid sputum would be expectorated for a few days. This symptom seemed to bear no relation to the intensity of radiological change. *Haemoptysis* occurred in 15 cases, and is discussed below.

Other Symptoms.—Epistaxis occurred during the first 24 hours after injury in Case 7. The tympanic membranes were

not inspected as a routine (the ear drums were examined only in Cases 1, 5, 11, 12, 16, and 17), but the only patient to complain of deafness was No. 11, who had a perforation of the right drum.

Physical Signs

Blood-pressure readings and pulse, temperature and respiration rates were recorded infrequently before admission to this hospital, but, with the exception of Case 18, the charts showed nothing remarkable after admission. This patient, whose temperature was 99°, pulse 88, and respiration rate 20 on admission, three hours after being blasted by a flying bomb, had a temperature of 104°, a pulse of 110, and a respiration rate of 36 fifty-six hours after admission. Examination then showed undoubted dullness and diminished breath sounds at the right base. Radiographs taken 24 hours before and 36 hours after this examination showed no abnormality, and agreed with an absence of abnormal physical signs at these times; it was thought that he had had a temporary partial collapse of the right lower lobe. He continued to have a low pyrexia—99 to 100°—for eight days after this, but the tachycardia and respirations subsided within 48 hours.

Generalized rhonchi were found commonly in those cases examined soon after injury, but lasted only for a few days. Cases radiologically clear on arrival here showed either nothing abnormal on physical examination (apart from muscular tenderness and limited respiratory excursions due to the pain) or the occasional rhonchus found in a large number of healthy chests. Dullness, diminished breath sounds, and decreased fremitus were present in those patients with heavy radiological shadows, clearing *pari passu* with the radiographs. Cases 15 and 16 had signs of effusion, and aspiration produced bloody fluid. Both haemothoraces cleared up with repeated aspiration.

X-Ray Findings

Ten of the cases showed no detectable abnormality in chest films taken within a few days of injury. Five of these were x-rayed within 36 hours of the incident, and in all but two patients a further film or films were taken later. Eleven cases showed radiological abnormalities in the chest at some time, and of these Cases 10 and 17, whose first chest films revealed nothing abnormal, developed respectively the appearance of interlobar fluid and a dense opacity in the left lower zone. Case 10, in which by the third day there was a shadow indicative of fluid in the right middle fissure, was not aspirated, but it seems likely that serous fluid or blood may have taken this time to accumulate. Case 17 had a clear film two days after injury, but a film taken on the fourteenth day showed a heavy opacity in the left lower zone, clearing remarkably quickly by the seventeenth day. Unless atypical pneumonia is postulated—and there was no corroboration by pyrexia or cough—this finding is difficult to explain, as even if haemorrhage into the lung is progressive the onset in this patient seems to have been very long-delayed. There was nothing specific about the shadows of the radiologically positive cases; they were unilateral in some instances, bilateral in others, and varied from increased density to the appearance of massive consolidation. All opacities were in the middle and/or lower zones, situated for the most part centrally. The shadows were confluent and not patchy. Phrenico-costal sinus pneumonia (Osborn, 1941) was not seen. Thomas (1941) has described hyperexpansion of the chest, but this was not a noticeable feature in the chest films of my cases. There seemed to be little correlation between the severity of the symptoms and the amount of damage as revealed by x-ray films. Tunbridge and Wilson (1943) are convinced that the extent of the haemorrhage is not always commensurate with the severity of the exposure to blast.

Haemoptysis

Haemoptysis has been an inconstant symptom of reported cases. None of those described by Dean, Thomas, and Allison (1940) coughed blood, though Hadfield (1941) found that haemoptysis commonly occurred an hour or so after injury. Livingstone (1940-1) reported occasional blood-stained sputum with loose cough. O'Reilly and Gloyne (1941) did not find haemoptysis to be persistent. It might be expected that haemoptysis would be related to the degree of haemorrhage—i.e., would occur in those cases showing massive x-ray shadows. This relation, however, was not found. Fifteen cases in all had

haemoptysis at one time or another; of these, nine showed no radiological changes after injury. Of the 12 radiologically positive patients only six had haemoptysis, and, furthermore, only Case 10 coughed blood or bloody sputum for more than one day. Contrasted with these, six of the radiologically negative cases had haemoptysis for 12, 11, 8, 6, 5, and 5 days respectively. The accompanying Table, in which cases are arranged in order of persistence of haemoptysis, shows the inverse relation of this symptom to the incidence of massive haemorrhage as revealed by x rays. Those whose haemoptysis was of brief duration coughed bloody froth after injury, whereas those with prolonged haemoptysis brought up pure blood, sometimes with clots, intermittently. The following case is illustrative:

Case 2

On Aug. 8, 1944, a mortar shell fell on this patient's gun. He was facing the explosion and was unconscious for eight hours. He then had difficulty in breathing, and lower retrosternal and upper abdominal pain; he was also coughing blood-stained froth. On examination generalized rhonchi were heard in both lungs. Radiologically the chest was clear.

Aug. 10.—Still having frequent haemoptyses (pure blood). Generalized rhonchi in both lungs. X-ray films of chest clear. He continued to cough blood once or twice a day until Aug. 15. Before each haemoptysis he had pain under the right ribs anteriorly.

Aug. 15.—No haemoptysis.

Aug. 16.—Haemoptysis began at 5 a.m.; fairly copious, with small clots. A few sonorous rhonchi in both lungs. Radiographs of chest showed slight frosting of periphery of left mid-zone (indefinite). Evening temperature 99°. Pulse and respirations normal.

Aug. 17.—No cough or haemoptysis. No abnormal signs. Radiographs of chest clear.

Aug. 18.—Haemoptysis; coughing small clots from 11 a.m. to 4 p.m. Temperature, pulse, respirations normal. No abnormal signs in chest. Posterior rhinoscopy showed nothing abnormal. Chest films clear.

Aug. 23.—No further haemoptysis since Aug. 18.

Cases 1 and 3 pursued a similar course. A civilian (not included in this series) injured by an aerial bomb early this year had haemoptysis for three weeks with repeated clear radiographs.

Considering the discrepancy between the degree of haemorrhage revealed by x rays and haemoptysis as a symptom, it seems possible that the source of bleeding in those patients with clear films may be bronchial. It was not desirable to submit these patients to bronchoscopy, but further investigation into the source of haemorrhage in such cases would be instructive. Hadfield (1940-1) mentions a patient showing no external signs of injury who recovered from his more urgent respiratory symptoms in the course of a few days, but had four attacks of haemoptysis during the next seven weeks. He believes that the major clinical manifestations are more probably due to capillary dilatation than to actual bleeding into the lung, which may be a consequence of capillary dilatation, and considers that one result of the detonation of high explosives is that the lung is left in such a condition that it is liable to bleed intermittently for a considerable time after the injury. His case is similar to the three cases in this series in which there was prolonged haemoptysis, but if his explanation is correct it should follow that those patients who show signs and radiological evidence of extensive diapedesis or capillary rupture would be the most likely to have prolonged haemoptysis.

Unilateral Lesions

Zuckerman (1940) has shown that rabbits exposed to lateral blast, the opposite chest being protected by cotton-wool, suffer more severe damage to the lung on the exposed uncovered side and less severe damage to the contralateral lung. Clinical reports of cases, so far as I am aware, have not stressed unilateral lesions; these were not likely to occur as most of the reported cases have been due to injury by aerial-bomb blast. Many of my cases were blasted by less powerful sources—e.g., mortar bombs or grenades—and some appeared to have been affected by the close-range detonation on one side only. Eight patients had unilateral abnormalities as shown by radiograph, although in some of these cases minimal lesions on the other side may have cleared by the time the films were taken. Five patients said that they were sideways-on to the explosions, and of these,

three gave unilateral shadows, the remaining two being radiologically negative. It seems reasonable to assume that, whatever the effect on the lungs, pain and tenderness of the chest muscles should occur on the side facing the explosion; but in two of the five cases (Nos. 4 and 11) pain with or without tenderness was experienced on the side opposite to that described as facing the explosion. The remaining three cases had pain on the exposed side, the following case presenting the anomaly of muscle tenderness limited to the arm and chest facing the detonation, with fluid appearing in the opposite interlobar fissure.

Case 10

This patient was injured on Aug. 8, 1944, by a hand-grenade which struck his left shoulder and exploded on or close to him. He was unconscious for a short time. On coming round he noticed soreness of the left chest and shoulder, and was coughing bloody sputum. On examination there was obvious dyspnoea, with generalized rhonchi in both lungs. Chest radiologically clear.

Aug. 9.—Still coughing blood-stained sputum.

Aug. 11.—Cough and haemoptysis. Pain in left chest and arm. Radiographs gave an appearance of a small effusion in the right middle fissure.

Aug. 12.—No change radiologically.

Aug. 15.—Some pain in left chest on breathing. Occasional cough; mucoid sputum; no haemoptysis. Examination disclosed tenderness in the left pectoralis major and shoulder-girdle muscles. No abnormal signs in lungs. Radiographs revealed only a small amount of fluid in the right middle fissure.

It would be unwise to draw conclusions from the case histories, for the evidence seems contradictory in two instances: No. 4, whose history was of a land mine exploding on his left side, the subsequent muscular pain and tenderness being on the right; and No. 11, who gave a history of a mortar bomb exploding on the right and presented the anomalous combination of a recent perforation of the right drum, the left being intact, and pain and tenderness of the left chest with radiological evidence of increased density of the left lower zone. Nor were any of the cases with unilateral histories and lesions comparable to Zuckerman's animals, for their chests were not protected on one side, and the blast may well have been received obliquely. Case 10, however, would seem to suggest the possibility of a contrecoup lesion if it were not for the difficulty of accepting such an effect on an organ so elastic as the lung.

Treatment

Treatment should be for the symptoms. Hadfield (1940-1) has emphasized the importance of adequate rest. None of these patients developed pneumonia—a not uncommon complication according to O'Reilly (1941); many of those showing evidence of massive pulmonary haemorrhage had been given up to 20 g. of a sulphonamide by the Army method of dosage of 5 tablets (2½ g.) twice a day during the first few days after injury, and this may well have prevented the complication. Physiotherapy would seem to be indicated for the muscular pain which is so prominent a symptom, followed by breathing exercises, but owing to pressure of more urgent work this could not always be carried out.

Summary

Twenty-one cases of blast injury to the lungs uncomplicated by other types of trauma are presented; the symptomatology, signs, and radiological findings are detailed. Haemoptysis as a persistent symptom is shown to bear no relation to the degree of pulmonary haemorrhage as manifested radiologically. Unilateral exposure to blast and the resulting lesions are found to have no constant relations; but in one case the possibility of contrecoup injury is mooted.

I would like to express my thanks to Dr. Geoffrey Doel for the x-raying of these patients and for his helpful co-operation at all times. I am also indebted to R.A.M.C. officers concerned for the early notes of the cases and in many instances for radiological investigations soon after injury.

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AN OUTBREAK OF JAUNDICE WITH SIGNS IN THE NERVOUS SYSTEM

BY

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In the steadily growing literature on infective hepatitis there is scant reference to lesions in the nervous system. In a series of 170 cases studied by Cameron (1943) the only neurological sign noted was a temporary paresis of accommodation in two cases. Newman (1942) refers to severe headache and to the occasional occurrence of paraesthesiae in the limbs. In none of his cases was the cerebrospinal fluid examined. Brain (1943) refers to one case in which unilateral convulsions and a hemiplegia, together with mild polyneuritic signs, preceded the onset of jaundice. Lescher (1944) gives three references to single cases of meningitis associated with infective hepatitis and describes two cases. A housewife aged 28 during an epidemic of infective hepatitis developed signs of a generalized polyneuritis which was followed one week later by jaundice; recovery was complete. In the second case an R.A.S.C. driver suddenly developed a left hemiplegia two months after an attack of epidemic hepatitis, from which he had made a complete recovery; there seems little justification for associating these two illnesses.

History of the Outbreak

The cases which are the subject of this note show the association of lesions of the nervous system with jaundice in several individuals living in close proximity. In Sept., 1943, a casualty clearing station in the Arakan, on the Burma front, was receiving a few cases of infective hepatitis each week, differing in no way from the usual type. Within two days 5 cases of jaundice with unusual neurological symptoms and signs were admitted. Four of these patients were from one British regiment and the fifth was an officer who had been working with this unit.

The history and clinical findings in four of the cases were very similar. The onset of the illness was sudden, occurring while the battalion was marching down to relieve another in the front line. All four men went sick within 48 hours of each other, with severe headache, dizziness, and a rise in temperature to about 104° F. Pain behind the eyes and generalized body pains, worse in the neck and in the back, were constant features. A "pins and needles" or tingling sensation rapidly developed in the arms and legs, with loss of muscular power, particularly in the lower limbs. Some degree of dimness of vision was noticed by each of the patients.

The fever lasted two or three days. A moderate jaundice developed on about the fourth day. When examined at the C.C.S. 10 days after the onset the following signs were noted. All four men were mildly jaundiced and bile was present in the urine. The liver was tender and enlarged and the spleen was palpable in all cases. The total and differential white counts were normal. The men complained of dizziness, dimness of vision, unsteadiness, and weakness of the limbs. On attempting to walk they staggered. During the first few days of the illness Kernig's sign had been reported as positive; a slight degree of neck rigidity still remained. The fundi were normal apart from a fullness of the veins in three cases. The remaining cranial nerves were normal. There was no loss of power, and no incoordination was present in the upper limbs. The arm and abdominal reflexes were normal. The lower limbs showed varying degrees of muscular weakness. The knee-jerks were diminished, though unequally on the two sides; in one case the right knee-jerk was absent. The ankle-jerks were absent. The plantar responses were flexor, except in one case which showed equivocal responses. In two cases there was definite sensory loss in the thigh—in one case on the anterior surface and in the other along the posterior surface. The cerebrospinal fluid was abnormal in three of the cases. In two a clot developed 15 minutes after the fluid had been withdrawn. The protein content was increased in three cases. Cell counts were 23, 14, and 11 lymphocytes per c.mm. The Wassermann reaction was