common following trauma, and they inhibit full active use of the muscle so that the patient is never able to get the maximum benefit from remedial exercises. They are due to localized fibrosis in areas to which traumatic exudates have gravitated. Deep massage is very effective, but it must be done properly—skin-stroking is useless. Preliminary injection with 2% procaine just below the muscle aponeurosis is helpful in many cases. Once the pain is abolished there is a dramatic increase in muscle power, showing that this was there all the time but was inhibited by the pain. In the analysis of disability referred to earlier it is important to distinguish this type of case from the one in which loss of power is due to atrophy alone, since the treatment is quite different.

Summary and Conclusion

In this paper the principles underlying the process of rehabilitation have been described. The final stages of this process are best carried out in special centres, but the earlier measures directed towards conservation of muscle function during immobilization are of equal importance.

The methods of treatment employed in a rehabilitation centre for injured miners are described. This centre was established by the employers of 100,000 workmen, the accident rate amongst whom is five times greater than the average accident rate in industry.

The only criterion by which success in rehabilitation can be judged is the patient's return to full pre-accident work and activity. Clinical attempts to assess this are unreliable. In a consecutive series of 1,200 patients treated in one year in the Mansfield Hospital Fracture Clinic, all of whom were miners injured at work, 87% resumed their full pre-accident occupation, and 9% resumed lighter work in the same industry. There was a mortality rate of 1%. In about 15% of the mining accidents dealt with in this clinic treatment is completed at the Miners' Rehabilitation Centre.

The Central Council for Health Education is able to command the services of some most talented people with the pen, pencil, and camera, and some of its leaflets, which are sold at production cost to local authorities and distributed in various ways by medical officers of health, are as telling as the very best commercial advertising. Three pictorial leaflets bearing the titles "Ears to Hear," "Eyes Right," and "Sleep" convey their message in a series of film-like pictures which make words largely unnecessary. A number of posters have also been brought out by the Central Council, and are so emphatic in their design and colour that he who runs may read. For those who may prefer to do their reading while not running there are a number of pamphlets on such subjects as the prevention of diphtheria, the war on lice, the elementary facts concerning milk, food, water, and sanitation, which lack nothing in the directness of the advice they give. A whole series of leaflets has been prompted by war conditions. Among them is a 16-page booklet on "Health in the Shelter," in which the clever levity of the drawings relieves the necessary seriousness of the text. It is the aim of the council to secure that every possible subject connected with health on which the public ought to be informed shall be illustrated by a popular leaflet or pamphlet. The war has opened up quite a number of new subjects, of which "Health in the Black-out," the title of a new leaflet, is one. The attractive booklet, "The Doctors tell you what to eat in Wartime," which was prepared by the British Medical Association at the request of the council, is another example of activity in this direction. It is suggested that some of these leaflets might be placed on the table in the waiting-rooms of medical practitioners. Medical practitioners, however much it may be against their mundane interests, are amongst the best apostles of preventive medicine, and we do not doubt that many of them will accept the invitation of the Central Council (whose address is Tavistock House, Tavistock Square, W.C.1) to have a free supply of this health publicity material sent to them for this purpose.

PULMONARY CONCUSSION ("BLAST")

BY

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"Every new ordeal to which the lung of man is exposed produces if not an entirely new lesion at least a new angle from which to study an old one."—LANCET.

"Pulmonary concussion" is a term which has been used for haemorrhagic lesions of the lungs resulting from the detonation of high explosive. Cases are recorded here which show that virtually the same syndrome can be brought about by the ordinary forces of civil life as by the action of bombs.

Experimental and theoretical considerations have now established beyond reasonable doubt that blast injuries of lungs are produced by the high-pressure wave of the blast acting for a short period; in other words, it is due to a sudden diffuse compression of the lungs through the chest and abdominal walls, and is typically unaccompanied by obvious injuries of the thoracic wall. "Diffuse" does not mean that the two lungs are equally affected, just as injury to the thoracic wall does not exclude the action of blast. A sudden diffuse compression of the lungs can readily be brought about by mechanical causes. More important under war conditions is the fact that the compression of blast and of mechanical forces frequently occur together. The most important difference between war and civil cases is the greater degree of violence in the former.

Comparison of Peace and War Injuries to the Lungs

I have notes of 94 necropsies made during the last three years on persons dying through road accidents. In reviewing these it is notable how many ribs may be fractured with no lung injury at all: 6 cases, all those of men between 58 and 69, had multiple rib fractures but no lung damage. Four more had multiple rib fractures and minor lacerations of the lungs from the rib ends, but no appreciable contusion of the lungs; these cases were those of a boy aged 13 and three men between 39 and 44. A man aged 21 showed lacerations and pulping of the lungs after an aeroplane crash. Three patients with fractures of the skull inhaled some blood; these were males aged 10, 13, and 19. Only 3 of the 94 had lung lesions comparable to those of the bomb cases; these were in girls aged 4 and 8, and a boy of 7. The best example is a girl of 4. A motor-lorry had run over her and caused a fracture-dislocation of the sixth and seventh cervical vertebrae, but no fracture of or external mark on the trunk. Her lungs showed multiple haemorrhages, which all appeared on the pleural surface; they were most numerous in the parts of the lungs which enter the phrenico-costal sinus of the pleura and posteriorly, but there was some rib marking on the lateral surfaces. The liver showed a small laceration of the posterior surface and there were some peritoneal tears in the transverse colon. The girl of 8 had been knocked down by a motor-car; she showed a little bruising over the left lower ribs but was otherwise unmarked; the ribs were not fractured. There was a haemothorax of nearly two pints on the left and a smaller one on the right. There was a large tear near the hilus of the left lung, and contusions were scattered fairly generally throughout both lungs. The liver was torn but the spleen was not. The boy of 7 was run over by a motor-lorry. He sustained an extensive fracture of the skull with brain injury. The trunk was not marked. The left lung showed a widespread haemorrhagic lesion about the hilus posteriorly, "rib markings" extending about three-

quarters of an inch deep, and a wedge-shaped contusion of the part in the phrenico-costal sinus. The right lung revealed innumerable haemorrhages the size of a pin's head, due to inhalation of blood from the left; the spleen showed a little superficial bruising only. The brain injury indicates that death must have been very rapid.

Lung injuries were therefore present in only 8 of the 94 cases. Of the 8 cases 4 were simple lacerations from fractured rib-ends and one was too gross to be of interest. The 3 most important cases were in children with flexible chest walls, and both were accompanied by abdominal injuries. The series does not include any case of compression asphyxia, but, looking through the series of asphyxial cases (suicidal hanging, homicidal strangulation, overlain babies, and babies born face down on to the placenta in a bucket), it is notable how inconstant Tardieu's spots are. My experience is the same as that given in Taylor's *Medical Jurisprudence* (1928), and does not agree with Ross (1941) that they "are nearly always found." They are interesting if found, but are so frequent in diseased conditions that they cannot be made a prominent part of any syndrome.

The four most interesting contusions of the lung did not occur in road accidents; they were described under the title of "phrenico-costal sinus pneumonia" (Osborn, 1940). The review of the road and bomb cases serves to emphasize the point made there that there is an abdominal component to the force which produces the basal contusion of the lung. If this wedge-shaped lesion is present the question is not "Is the underlying spleen or liver damaged?" but "How severely is it damaged?" It may be a trivial bruise or a hopeless tear.

The first 8 cases described below were from bombed houses.

Case 1.—A girl aged 17. Fractured skull the only external injury, no bruises or fractures about the chest or abdomen. The lungs showed a large wedge-shaped haemorrhage at the left base and a much smaller one at the right base; a fairly large haemorrhage into the posterior part of the right mid-lobe; haemorrhages posterior to the hilus on each side; and some small pleural haemorrhages laterally which were possibly "rib markings." Most of the haemorrhages reached the pleural surface. The upper pole of the spleen showed multiple tears; the liver and other abdominal organs were undamaged. This girl had blood-stained mucus and froth in the large air passages.

Case 2.—A woman aged 42, mother of the previous patient. She was beside her daughter when the house was hit, and also had a fractured skull. The upper three left ribs were fractured and the lung showed contusions in this region only; small haemorrhagic spots elsewhere were probably due to inhalation of blood. The lung changes in this case were very mild compared with those of the daughter; this may be because the mother was obese. She had no abdominal injury, and lived for about twelve hours after being hurt.

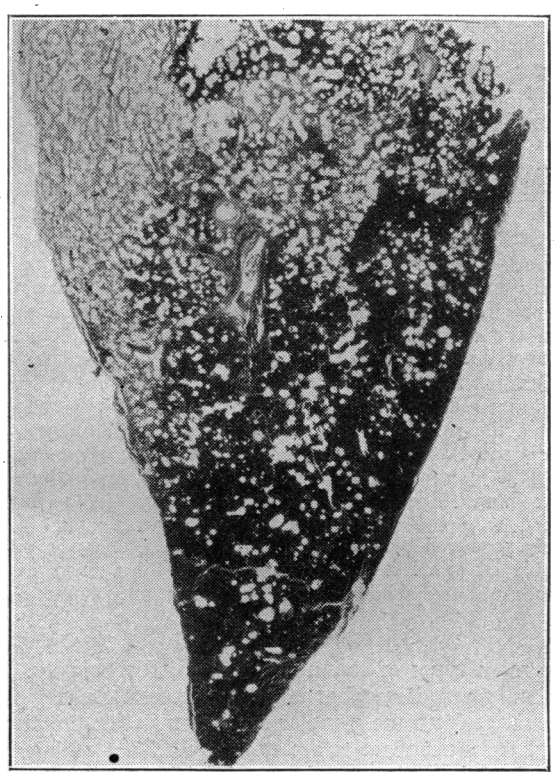
Case 3.—A girl aged 16 had multiple injuries which included pieces of wood driven into the trachea and left lung. There were scattered small haemorrhages throughout the lungs; a large one into the base of the right lung was accompanied by a ruptured liver beneath. The right hand and forearm had been blown off.

Case 4.—A young unidentified woman who was too mutilated for lesions to be instructive.

Case 5.—A man aged 40 who had a compound fracture of the skull but no injuries to the chest or abdomen.

Case 6.—A woman aged 40, wife of the previous patient, average size, not obese. There were large numbers of punctured wounds over the exposed parts of the body (head, neck, arms, and legs); with few exceptions these were superficial and did not contain foreign bodies. The largest were in the right suprascapular and supraclavicular regions; through the latter the axillary vessels had been pulped. This injury was of interest because it was evidently the place where a collection of dirt particles measuring 1 by 0.3 by 0.3 cm. had entered the vein to lodge in the right ventricle; the heart itself was not damaged. The skull showed four perforations about 1.5 cm. in diameter in the frontal and parietal regions; bone had been driven into the cerebrum through two of these. Both orbital plates of the frontals were fractured upwards, with orbital contents projecting through; there was no injury about the eyes to account for this. The base of the skull was not damaged otherwise, but there was haemorrhage into the middle and internal ear on the left side. The chest was free from external marks, but the upper four right ribs were fractured posteriorly at their angles; these had not caused any laceration of the lung. The right apex showed a healed tuberculous focus 1 cm. in diameter, the left apex a smaller lesion. Old adhesions were present over the right upper lobe and the left apex. The right pleural cavity contained half a pint of blood, the left none. Much blood and mucus (not frothy) were present in the trachea and large bronchi. There was a massive haemorrhagic lesion of nearly all the right upper and mid lobes; the right lower lobe was normal. Scattered throughout the left lung were very large numbers of small haemorrhagic spots due to inhalation of blood from the right side (see below). No pleural haemorrhages were observed on the left side. There was no phrenico-costal sinus lesion and no injury to the abdominal organs. This woman lived three hours.

Case 7.—A woman aged 26, of average size and nutrition. There was a perforating wound of the left chest posteriorly about the inferior angle of the scapula. A bomb splinter



Phrenico-costal contusion (Case 7). Photomicrograph (× 3) of wedge-shaped haemorrhage into base of right lung. The clear parts in the dark haemorrhagic zone are mostly distended alveolar ducts and small bronchioles. This lesion always suggests laceration of the underlying liver or spleen.

weighing 2.5 grammes had passed through the seventh rib here, through the left lung in the interlobar region, through the anterior part of the pulmonary artery and the right cusp of the pulmonary valve, and had come to rest in the right ventricle close to the tricuspid valve without doing any damage in the ventricle. There was free haemorrhage into the lung along the path of the bomb fragment and also posteriorly; the left base was practically clear. The right lung was normal except for a perfect example of the phrenico-costal sinus contusion (see Fig.). This was placed laterally and posteriorly, was wedge-shaped, and measured 7 cm. from

front to back, 4 cm. upwards, and about 3 cm. deep at the upper part, which was appreciably raised from the surrounding normal lung on the pleural surface. This haemorrhage was firm, but lacked the almost stony hardness of the lesion in the civil cases which survived some days. There were multiple tears of the liver, tears of the upper pole of the spleen, and a superficial tear of the upper pole of the left kidney.

Case 8.—The 7-months-old baby daughter of the previous patient. She had a depressed fracture of almost the whole of the left frontal bone with brain tissue protruding around it. There were no other marks of any sort on the body. The lungs showed very distinct haemorrhagic rib markings laterally on each side; these became confluent in several places, notably the posterior portion of the right lung. In parts the rib markings extended a full centimetre into the lung, and were separated there, as on the surface, by clear lung tissue. All haemorrhages in these lungs were represented on the pleural surfaces. The only haemorrhages not related to rib markings were on each side in the part of the lung that enters the phrenico-costal sinus. These were not relatively as large as the wedge-shaped lesion in Case 7, but were associated with several tears in the liver. The abdominal organs were otherwise normal.

The following two very recent cases, which have a bearing on the mechanism of production of the lesions, may merit a brief note.

Case 9.—A girl aged 11 collapsed under an anaesthetic of open ether just as an operation for the removal of an acutely inflamed appendix was being completed. As she did not respond to the usual methods an upper abdominal incision was made and the heart was massaged. The auricles started beating, but not the ventricles. At necropsy she appeared to have been a healthy girl. She was deeply cyanosed; the blood was dark and fluid. There was extensive bruising of the ventricular muscle from the massage. This bruising was not beneath the pericardium, where the direct force had been applied, but was a very short distance from the endocardium. The endocardium was not injured. The bruising appeared to have been produced by the reactionary force of the compressed blood.

Case 10.—A baby girl aged 15 months was brought to the Infirmary moribund; she had inhaled a piece of bean four hours previously. This blocked the left main bronchus and part of the right. When seen by the casualty surgeon she had stopped breathing, but the heart could be heard beating infrequently. Artificial respiration was applied, but failed to revive the child. At necropsy the left lung was seen to be collapsed, the right partly collapsed. Very small numbers of Tardieu's spots were present, but haemorrhagic rib markings beneath the visceral pleura were quite distinct, especially over the left lung. The rib markings were very shallow when compared with cases from the bombed houses. They were probably produced by the artificial respiration, and were more noticeable on the left side because the left lung was extensively consolidated while the right still contained some air.

Microscopical Features

Two main types of lesion are seen microscopically. In the primary and larger haemorrhagic lesions there is free haemorrhage from the alveolar capillaries, while the alveolar ducts and bronchioles are typically air-containing and almost free from haemorrhage. The larger bronchioles and small bronchi in the worse lesions—e.g., the right lung of Case 6—give good evidence of compression of the lung from without. They are collapsed, and practically all the goblet cells in the mucosa have been ruptured, causing a stream of mucus to flow into the bronchial lumen; with the mucus is a little blood but very little air. The mucous glands and the basal, intermediate, and ciliated cells of the bronchial mucosa are little affected compared with the goblet cells. Incidentally this shows well how much mucus is available from goblet cells alone to make the bronchial mucous plugs of the influenzal lung. The relative scarcity of goblet cells in that part of the lung which enters the phrenico-costal sinus may account for the difficulty in recognizing this lesion in the wedge-shaped haemorrhages there. Rupture of goblet cells appears to indicate severe lung damage. Distension of alveoli with blood or air (emphysema) regularly accompanies compression haemorrhage, and subpleural bulla formation is fairly common.

The second main type is the result of inhaled blood, and is apt to be mixed with the previous type. Blood is present in the small bronchi of the affected region, and distension of alveoli is not usually as marked. Typically this lesion is relatively small and scattered, and in my cases has been accompanied by much more serous exudation in the surrounding alveoli than is seen in the compression haemorrhage. Goblet cells are, of course, not ruptured.

Is the Haemorrhage Progressive?

Hadfield and Christie (1941) state that they regard the haemorrhage in these cases as being progressive and that "in reviewing a series of post-mortem examinations of 17 of these cases we have been struck by the variability in extent of these haemorrhages, and it appears reasonable to relate this variation to the period of survival after exposure to detonation." With these statements I am quite unable to agree. The haemorrhagic lesions themselves are not necessarily fatal, though it is easy to imagine rapid death from shock. The most probable reason that their patient lived fifty-one hours is that the abdominal component appears to have been confined to submucous gastric haemorrhages. There are too many unknowns in my cases as well as in those described by Hadfield and his colleagues (1940) to imagine that we can correlate the extent of the lesion with the period of survival. Of these published cases the period of survival was known in only 4 out of 19, and though the notes of 2 are scanty it would appear that 3 out of the 4 patients who survived some time were not as badly affected as some who died more rapidly. The probable reasons for more severe lung lesions are the severity of the causative force and the state of the patients. By the state of the patients is meant whether they are obese or not, whether they have flexible or rigid chest walls, whether their lungs are in the position of inspiration (making it worse) or expiration at the time of injury, and the amount of clothing worn by the victim. It is the state of the patient which explains why these cases did not attract attention during the last war. The potential victims then were grown men wearing a respirator, knapsack, and other things which would protect their body walls from the impact of the blast wave; now we are seeing unprotected girls and children attacked by bombs in confined spaces. Some direct evidence can be given indicating that the haemorrhage is not progressive. First, the haemorrhage is into alveoli which are arranged in limited groups. Only a little of this blood gains access to a bronchus to reduce the raised pressure due to the haemorrhage. Secondly, the haemorrhage is from capillaries. Capillary haemorrhage typically ceases within about five minutes and requires only a slightly raised pressure to stop it. Thirdly, the cases of "phrenico-costal sinus pneumonia" seem to prove that the bleeding is not progressive. The wedge shape, size, and raised pleural surface laterally and cranially are similar in the cases of bomb injury and in the patients who survived for two and seven days. In the last two cases the most advanced organization was at the upper end of the lesion near the unaffected lung tissue: here the alveoli showed much more fibrin, and phagocytic cells were more active. There was no evidence of more recent haemorrhage at the upper limit of the lesion, and the best-preserved red cells were in the centre of the lesion, where it appeared that resolution would take longest. For these reasons I believe that the primary lesion is not progressive, but the reaction to the lesion may make it appear to be so, especially in *x*-ray plates.

Mechanics of Haemorrhagic Concussion of the Lungs

Reasons for believing that the lesions are due to the high-pressure wave of the blast acting on the body wall and not to positive or negative pressures acting through the trachea and bronchi are given by Zuckerman (1940), and need not be repeated. Additional proof is given here by (1) the mechanics of "phrenico-costal sinus pneumonia" (Osborn, 1940), and (2) the goblet-cell lesion and collapse of the bronchi in the worse cases.

Zuckerman (1941) goes to some pains to belittle the effects of blast unless the victim is very close to the bomb, and states that there have been very few cases of blast injury of the lungs in England so far. Lung injuries having the features described by Sir Joseph Barcroft (1939) and by Zuckerman in animals are now only too common in hospital practice. An attempt has been made here to show that the same lesion may result from a sudden diffuse compression of the chest and abdomen by bombs and mechanical means. Whether the lesion is entirely due to blast or not seems to be of little more than academic interest. Zuckerman may be correct when he says that there is little danger from blast more than thirty feet away from the explosion of a big bomb in the open, but there is no justification for belittling the effects of blast in confined spaces such as houses. We have no means of telling what blast pressures the victims in houses were exposed to: the positive pressure there cannot fall until free access to the outside air is obtained. There is also no justification for his statement that "at sixty or seventy feet the pressures did not really matter at all clinically, even though they might be sufficient to damage walls and windows" and "throw a man against a hard surface." Zuckerman's statement is usually true just as it is usually true that if we fall over we will not die of "phrenico-costal sinus pneumonia"; in each case, however, it is how the violence is applied that matters, and the unusual in each case may be common in medical practice if sought after.

What is the force which actually brings about the capillary haemorrhage in haemorrhagic concussion? Two forces have to be considered. These are the compression of the lungs through the chest wall and diaphragm and the counter-pressure exerted by the air in the alveoli. When danger threatens it is instinctive for the muscles to go "on guard"; this includes spasm of the glottis more or less locking the air in the lungs. The high pressure produced in this alveolar air by compression is the most likely force which ruptures the capillaries. This explains why the haemorrhages are deep and often massive; it may also help in understanding their distribution. In my cases this type of haemorrhage has mostly occurred in young adults and has not been associated with rib markings. Haemorrhages from the primary force are likely to be found in cases in which reflexes are not well established—e.g., in small babies and experimental animals. Thus Case 8 is a perfect example of haemorrhages produced by the ingoing ribs, etc., in a baby of 7 months. Other cases—e.g., Case 1—show a combination of both types of force. The findings in the baby's case certainly do not support Ross's (1941) statement that rib markings are a feature of "compression asphyxia" in which "death has presumably been slow, with attempts at respiration"; at least I am sure that this baby died quickly. I cannot see how Ross correlates Sir Joseph Barcroft's and Zuckerman's findings in pure blast injuries of animals with her statement that "in haemorrhagic concussion the lesions are always bilateral and roughly symmetrical. There is general congestion of the lungs. Pleural haemorrhages are present only as an extension from deeper areas." Rib markings were the main findings in goats: "These lesions consisted of bruising of the surface of the lung in the line of the ribs and vertebral borders, and extended for one-quarter to half an inch into the tissue of the lung": this is also a description of the baby (Case 8). Zuckerman showed that one lung might protect the other if the animal was placed side-on to the explosion: this apparently is more likely to happen if the animal is fairly close to the explosion. To understand the lesions described for blast in animals and man there is no need to assume that blast has any mysterious properties; it is only a more severe diffuse sudden compression of the chest and abdomen than we see in civil cases during peacetime.

Main Clinical Features of Pulmonary Concussion

The great majority of cases so far reported have come from bombed houses and shelters: pulmonary concussion appears to be infrequent in cases injured in the open. In houses it takes longer to dissipate the high-pressure wave of the explosion, and mechanical factors are likely to be added to the blast effects. Pulmonary concussion should be looked for in every case from a bombed house.

Factors tending to minimize pulmonary concussion are advancing years, obesity, rigidity of the chest wall, the position of expiration, and thick clothing. Pulmonary concussion may take a number of forms, which depend on the state of the patient as much as on the degree of violence. The younger the victim the more probable is it that the haemorrhagic lesions will be subpleural ("rib markings"). Young adults usually have deeper haemorrhages. Much mucus in the air passages (with blood) indicates that goblet cells have been ruptured in the bronchial mucosa; this means that the lungs are severely affected.

So far too little attention has been paid to the fact that the abdomen is suddenly compressed as well as the thorax. The wedge-shaped lesion of the part of the lung which enters the phrenico-costal sinus of the pleura is of exceptional importance because it indicates with a high degree of probability that the underlying liver or spleen, or both, have been torn. If these tears are severe the victim will be found dead; doubtless some will be amenable to surgical intervention. In my small series the liver and spleen were affected much more often than the bowel; bowel tears were confined to the peritoneal surface and would have needed no treatment. Should operation ever be indicated the organ responsible for the abdominal haemorrhage is likely to be demonstrated by the side of the phrenico-costal sinus lesion. If this is placed posteriorly as well as laterally on the right side the tear in the liver will probably be inaccessible. Tears of the spleen are likely to be at the upper pole.

Pulmonary concussion is not necessarily fatal. Sir Joseph Barcroft found that his goats usually recovered if they were not killed rapidly; Zuckerman also found his smaller animals tended to get better. It is worth recalling that in one of my cases of "phrenico-costal sinus pneumonia" death resulted from acute pulmonary oedema after two days, and in another case death occurred from pulmonary embolism after seven days. The latter cause of death is preventable: it is due to stasis in the femoral veins allowing the formation of clot, which becomes detached after about a week and is then carried to the right heart and pulmonary artery. Pulmonary embolism is prevented by regular active movements of the lower limbs aided by raising the foot of the bed to prevent haemostasis and by avoiding dehydration and other causes of haemoconcentration. If the patient does not die soon death may result from complications such as these, and probably the most important thing in treating haemorrhagic concussion of the lungs is to anticipate and so prevent such complications.

A "very clear history of the incident" cannot be obtained by the clinician, and its importance in diagnosis and treatment has been much exaggerated. It is of great value to know that the case is from a bombed house or shelter, and this is nearly always known. With this knowledge the most accurate diagnosis of the state of the lungs will be made by a consideration of the state of the patient (see above) and not from a knowledge of the size of the bomb. The peculiar behaviour of blast on houses is now so familiar (e.g., I have seen a shop window within six feet of a bomb crater in the road with only a single crack) that it is just as likely as not that the clinician would be misled by a "very clear history of the incident." The clinician will not be misled if he applies sound clinical methods, which should include repeated radiographs, if possible, and special attention to the phrenico-costal sinus region.

The knowledge that the case has occurred in a confined space will also help the clinician if he keeps in mind the important observation of Hadfield and his colleagues that these patients are prone to suffer from carbon monoxide poisoning.

Summary

Cases of pulmonary concussion from civil life and bombed houses have been compared.

Pulmonary concussion is almost the rule in cases from bombed houses, but not from bomb injuries in the open.

The mechanism of the lesion is considered. In bombed houses mechanical factors may add to the effect of the blast pressure.

The state of the patient is probably of greater importance than the size of the bomb or the distance from it. Knowledge of the details of the bomb may be misleading. In houses the positive pressure cannot fall until walls and roof are blown open.

The actual lesion is mainly haemorrhage from alveolar capillaries. Only a little blood gets into the bronchioles, etc., in these parts. Rupture of goblet cells and liberation of much mucus indicates a severe lesion. Secondary inhalation of blood gives a different picture.

Certain parts of the lungs are predisposed to injury. Thus we find subpleural "rib markings," injury in the phrenico-costal sinus region, and deep and posterior lesions in the region of the hilus. A consideration of primary (compression) and reactionary (counter-pressure of air locked in alveoli) forces may explain differences.

The abdomen is typically compressed with the thorax. The most important lesions here are tears of the liver and spleen.

The lesion itself is not progressive, but the reaction is. Treatment is largely anticipation of complications. The usual methods of artificial respiration may cause pulmonary concussion.

I am indebted to Detective-Sergeant J. S. Fayers for the photomicrograph.

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The London Hospitals Street Collections Central Committee (36, Kingsway, W.C.2) has issued a leaflet with reference to Hospitals Day in 1941, which includes a message from the Patron, H.M. the Queen. As in 1940, all participating hospitals will have the opportunity of collecting both in May and in October; the dates chosen are Tuesday, May 6, and Tuesday, November 7. A list is given of the hospitals co-operating and the amount received by each from last year's combined street collections, which totalled over £46,000.

ELECTRO-ENCEPHALOGRAPHY IN TRAUMATIC INTRACRANIAL HAEMORRHAGE

BY

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Electro-encephalography is becoming more and more important in the detection of various intracranial lesions, and Berger's contention that the phenomena which he described would afford a means of diagnosing certain pathological conditions of the brain may be said to have been generally upheld. So far, however, electro-encephalography has not been used to any extent in the investigation of cases of head injury; consequently it would appear desirable to record such evidence as may be obtained concerning its value in these cases, particularly when intracranial haemorrhage has occurred. Records from cases of traumatic intracranial haemorrhage are conspicuously few. In this country Prof. Rendle Short and Miss Dunster (1940) have published the findings in the case of a patient aged 42 with a middle meningeal haemorrhage upon whom operation was successfully performed. A tracing from a case of chronic subdural haematoma in an Italian aged 41 is included in a paper on electro-encephalography by Balado, Romero, and Noiseux (1939) of Buenos Aires; and some examples of intradural haemorrhage, both extra- and intra-cerebral, have been noted by Jasper, Kershman, and Elvidge (1940) of Montreal. The case here noted is a further instance of an encysted subdural haematoma following head injury which at the time of operation presented singularly few symptoms.

Case Report

On July 24, 1940, a marine aged 20 was knocked out in the boxing ring, and on regaining consciousness a few minutes afterwards had a severe headache. An hour later he vomited. He did guard duty that night, however, and was able to go out on a route march next day. His headache, which was now chiefly in the left frontal and occipital regions and at times was accompanied by pain in the back, continued, so he reported sick and was admitted to hospital. There was neck rigidity at this time, his temperature was 99° F., and his pulse was consistently slow (48 to 50). Both optic disks were blurred; the tendon reflexes were normal and the plantar responses flexor. Leucocytes numbered 10,000 per c.mm., *x*-ray examination of the skull was negative, and the cerebrospinal fluid pressure in the lumbar pond was 250 mm. of water; the fluid itself being deep yellow in colour, with a protein content of 120 mg. per 100 c.cm. The chief symptoms now were headache and photophobia, but these got better as he rested in bed. On August 29 Surgeon Captain Macdonald Critchley and I were called in to see him. He was inclined to be fatuous, the left knee-jerk was brisker than the right, and the left plantar response was extensor. High papilloedema with exudates and retinal haemorrhages was present in both optic disks. On September 24 Mr. W. Grey Walter, to whom I am much indebted for the tracing (see Fig.), carried out electro-encephalography at the Burden Institute under the direction of Dr. Golla, and reported: "There is a very low potential discharge at varying frequencies in the right fronto-temporal region, most definite in the neighbourhood of the Sylvian point. The small size and irregular frequency of this discharge would suggest that it is vestigial and not associated with any active destructive process." On September 7 the patient felt quite well, was free from headache, and declined operation. The highly choked disks, however, were still present, and, because of these and the slight left pyramidal signs and the electro-