the injury, and the plasma volume 12½ hours after was about 2.8% of body weight. The haemoglobin was 11.8 g./100 c.cm. There was a temporary improvement after the first transfusion, but the blood pressure subsequently fell to 85/50 mm. Hg, and two bottles of plasma were given, therefore, between 10½ and 15½ hours after the injury. A second determination of plasma volume 19½ hours after the injury gave a figure of about 3.8% of body weight; the haemoglobin was 11.4 g./100 c.cm. Anaesthesia was begun 21 hours after the injury, and the blood pressure rose from 100/55 to 110/65 mm. Hg in the first 4 minutes and then fell steadily to 80/50 mm. Hg in the next 15 minutes. Ether was stopped after the first 7 minutes. The blood pressure was then maintained at 85/50 mm. Hg until the operation ended 49 minutes after the anaesthetic began. During the next 12 hours the systolic pressure rose to 140 mm. Hg, although eventually the patient died with a gangrenous leg.

In less severe cases nitrous oxide and oxygen with a minimal amount of ether may cause the blood pressure to rise, as demonstrated by Case 3. This patient sustained a compound fracture of the left tibia and fibula. His blood pressure was 110/60 mm. Hg 40 minutes after the accident, and his plasma volume was 4.3% of body weight and haemoglobin 12.2 g./100 c.cm. two hours after. No transfusion was given. When anaesthesia was begun 5½ hours after the accident his blood pressure was 130/70 mm. Hg. It rose to 170/75 mm. Hg in the first ten minutes and then fell gradually to 140/75 mm. Hg in the next 25 minutes, remaining there till the operation ended 50 minutes later.

The best anaesthetic used in our shocked patients was cyclopropane and oxygen. It was employed in Case 4. This patient, who had a crushed foot and lacerated scalp, had a plasma volume of 3.8% of body weight and haemoglobin of 14 g./100 c.cm. 30 minutes after the accident. The blood pressure was then 100/60 mm. Hg. Anaesthesia was begun three hours after the accident, and the blood pressure rose slightly to 110/80 mm. Hg, where it remained for the next 20 minutes. At this time the cyclopropane was gradually changed to ether for the purpose of comparison, and the blood pressure fell during the next 15 minutes to 80/60 mm. Hg. After withdrawal of ether the blood pressure recovered, and it was maintained at 100/70 mm. Hg during the last five minutes, when cyclopropane was given again.

In attempting to assess the depressing effects of anaesthetics on the cardiovascular systems of shocked patients it is necessary to emphasize that quite severe injuries can occur with little reduction of plasma volume. This may explain why the lowering of blood pressure by an anaesthetic is sometimes less than might be expected. It occurred in Case 5, a man who sustained a compound fracture of the left femur and a right Colles fracture. His plasma volume was within the lower limit of normal—about 4.8% of body weight—his haemoglobin was 8.8 g./100 c.cm., and his blood pressure was 110/60 mm. Hg three hours after the accident. During the next 11 hours his general condition remained about the same and his blood pressure was 110/70 mm. Hg when intravenous anaesthesia with sodium pentothal was begun. It then fell steadily to 85/55 mm. Hg in the next six minutes, and remained at about this level until the anaesthesia ended 25 minutes later.

The chief factors in anaesthetizing shocked patients seem, therefore, to be, first, the use of a minimal amount of anaesthetic—and it is often surprising how little these patients require; secondly, the choice of an anaesthetic which stimulates rather than depresses the cardiovascular system; and, thirdly, an adequate amount of oxygen. It is unfortunate that the two most satisfactory anaesthetics—cyclopropane and oxygen, and nitrous oxide, oxygen, and ether—both require somewhat elaborate apparatus. Fortunately, however, in modern war it is possible for the great majority of patients to be brought back for operations to base hospitals where such apparatus is available.

Summary

Plasma volume and haemoglobin concentration were measured repeatedly in 26 patients undergoing various operations under nitrous oxide, oxygen, and ether, cyclopropane and oxygen, sodium pentothal, and spinal analgesics. No significant changes were found, although marked alterations in blood pressure occurred.

Serial electrocardiograms examined in nine patients showed no constant changes even though a marked alteration in blood pressure had taken place.

It is concluded that anaesthetics affect blood pressure mainly through the vasomotor system.

Cyclopropane and oxygen tended to raise the blood pressure; nitrous oxide, oxygen, and ether had variable effects on it; sodium pentothal and spinal analgesics depressed it.

In patients whose plasma volume was reduced by trauma there was a greater tendency for these anaesthetics to depress blood pressure.

Cyclopropane and oxygen was the best and nitrous oxide with adequate oxygen and a minimal amount of ether was the next best anaesthetic for these cases.

We are indebted to Dr. Miles for access to clinical material and to Mr. Whittingham and Dr. Murdoch for their co-operation in the cases undergoing major operations at Oldchurch Hospital, Romford. Dr. William Evans kindly examined the electrocardiograms for us.

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THE USE OF PENICILLIN PASTILLES IN ORAL INFECTIONS

A PRELIMINARY REPORT

BY

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In July of this year it was decided to attempt to treat various types of oral infection with local penicillin. Previous experience had shown that the use of a spray was unsatisfactory in the treatment of acute tonsillitis, presumably owing to the transient action so exerted, and it was felt in consequence that, if any success were to be obtained, a means of maintaining an adequate concentration of penicillin in the mouth would be required.

It was therefore decided to try the effect of penicillin contained in a pastille. For this purpose a slow-melting medium unlikely to cause excessive salivation, approximately neutral in reaction, and not containing any penicillin inhibitor, was required. This was found in gelatin. To the gelatin base 0.1% nipagin was added in order to preserve the pastille, though whether this was necessary is doubtful, as pastilles kept over a period of three months do not appear to have deteriorated, apart from a slight hardening of the medium. In the preparation of the pastilles care was taken that the penicillin was not subjected to excessive heat; it was added to the gelatin base at 42° C. and stirred in just before the latter was about to set. Pastilles were cut to a standard size of approximately 3/8 in. square and 1/8 in. thick to facilitate insertion and retention in the buccal sulcus, and for trial purposes they were made in varying strengths from 1,000 units of penicillin to 100 units in each pastille.

With these pastilles experimental work was then carried out in order to determine: (1) that the penicillin derived from the pastille was present in effective concentration in the mouth, and that this concentration could be maintained; (2) that the incorporation of the penicillin in the pastille base would not interfere with its action, and that the pastille would keep and would remain active after its manufacture; (3) the effect of the pastille on the mouth and throat and their bacterial flora; (4) the required dose of penicillin in each pastille.

The results of these investigations were as follows:

1. A pastille containing 500 units of penicillin was allowed to melt in the buccal sulcus. After 15 minutes the pastille was removed and the penicillin content of the saliva was estimated by the standard technique. Further estimations at 15 and 30 minutes after removal

of the pastille were also made. These investigations showed that penicillin was present in the saliva in large quantities immediately after removal of the pastille and in fair quantities after 15 minutes, and was still present in small quantities up to 30 minutes after removal of the pastille.

2. The experiments described above showed that the penicillin remained active in the gelatin base, and similar experiments repeated on pastilles three months old have shown that there is no apparent diminution in their activity after this period.

3. Investigations on the effect of the pastilles on the bacterial flora of the mouth and throat have produced many interesting results from the bacteriological point of view. It is not felt that these results lie within the scope of the present paper, and they will therefore be reported in detail at a later date. It must be mentioned here, however, that it is possible greatly to reduce the number of organisms and even to produce sterile cultures. Numerous control cultures in which penicillinase has been employed to neutralize any penicillin present have shown that any decrease in the number of organisms cannot be due merely to penicillin having been transferred with the organisms on the swab to the culture medium. Further control experiments were performed in which pastilles made of the normal base but without penicillin, and similar pastilles without penicillin but containing citric acid, were employed in the same manner as the pastille containing penicillin. These experiments showed that there was no appreciable alteration in the bacterial flora when penicillin was absent from the pastilles, even with the excessive salivation evoked by the pastilles containing citric acid. The effect of the penicillin pastilles on the organisms associated with Vincent's infection and on haemolytic streptococci will be dealt with when the treatment of disease associated with these organisms is described.

4. The standard dose adopted is 500 units of penicillin in each pastille, although in cases of acute ulcerative gingivostomatitis (Vincent's type) pastilles containing only 250 units are now employed, as this strength has been found adequate in treatment. It is possible that pastilles containing 1,000 or more units might prove even more effective, but limitation in the supplies of penicillin has made it imperative to use the minimum adequate dose.

Method of Employment

Patients were seen daily for clinical and bacteriological control. On starting treatment each patient was instructed to place a pastille in the buccal sulcus, to leave it there until it had dissolved without chewing or sucking, and then to replace it with another. The time taken for the pastille to dissolve varied in different patients, and in general tended to be shorter in the earlier and more acute stages of the infection owing to the greater degree of salivation. The average, however, was about three-quarters of an hour. Particular instructions were given that a pastille should be inserted last thing at night and that it should be replaced should the patient wake. Great attention was paid to seeing that the patient fully understood the instructions given and the importance of regularity in the taking of the pastilles, since it was clear that much depended on intelligent co-operation. Apart from one patient who in error ate 10 pastilles in the first five minutes of treatment, we have received excellent co-operation. The very slightly bitter taste of the pastilles does not appear to be noticed in the presence of an acute oral infection, and even in the normal mouth it is not actively unpleasant.

Cases were divided into the following groups: (1) Acute ulcerative gingivostomatitis (Vincent's type). (2) Acute streptococcal tonsillitis (including scarlet fever). (3) Chronic streptococcal throat carriers. (4) Operations in the mouth and lesions of the oral cavity involving loss of surface: in this group were included post-tonsillectomy cases, fractures of the mandible compound into the mouth, trauma to the bone and mucosa following difficult dental extractions, and ulcerative conditions of the mucosa other than Vincent's.

1. Acute Ulcerative Gingivostomatitis (Vincent's Type)

So far, 25 cases of this type have been treated, including one of glandular fever and three in which the disease, of very severe form, was subsequent to a bismuth stomatitis while under treatment for syphilis. The response is best studied under the headings of "clinical" and "bacteriological."

Clinical.—All patients became asymptomatic in 24 hours, including several severe cases with pain, insomnia, and general symptoms. At the same time the characteristic fetor had gone. In 48 hours the sloughs on the ragged edges of the gums had disappeared, together with the signs of acute inflammation in the gums themselves. Epithelization of the ulcerated areas

proceeded rapidly, and within five days the improvement in all cases was such that treatment was stopped. No patient had any treatment other than the pastilles, and no attempt was made to clean the gum pockets by syringing, mouth-washes, or instrumentation. Patients have been inspected at fortnightly intervals after the cessation of treatment and no relapse has yet been seen, though the shortness of the period during which the investigation has been conducted (three and a half months) clearly does not allow any conclusions to be drawn in this respect.

Bacteriological.—Twenty-four hours after treatment had started it was found that the spirochaetes which had previously been present in large numbers were absent, while the fusiform bacilli were much reduced. In 48 hours the fusiform bacilli were further greatly reduced and in many cases absent. In 72 hours both spirochaetes and fusiform bacilli were entirely absent, and at this stage it was a common experience to find that the films showed epithelial tissue with very few organisms of any sort. Films made at weekly and fortnightly intervals after cessation of the treatment have shown no evidence of recurrence in any patient. In order to be certain that the clinical and bacteriological improvement was due to penicillin and not to salivation or other mechanical factors, one patient with a severe infection was given pastilles made of gelatin and 0.1% nipagin only. There was no clinical or bacteriological improvement after 48 hours. Treatment with penicillin pastilles was then started. Films taken 24 hours later showed no spirochaetes or fusiform bacilli. This result coincided with clinical improvement, and a rapid cure ensued.

2. Acute Streptococcal Tonsillitis

As already stated, it was shown experimentally that it was possible very greatly to reduce the number of bacteria in the normal mouth and throat, and it was therefore evident that the penicillin was at least effective superficially. This diminution in the number of organisms, including the haemolytic streptococcus, suggested that the pastilles might be of practical value in the reduction of droplet infection. It was doubtful whether it would penetrate deeply enough into the tonsillar crypts to be effective in cases of tonsillitis, but its high diffusibility did not rule out the possibility, and it was therefore decided to try the pastilles in a group of patients with acute tonsillitis.

So far, 17 patients have been treated, and all showed pyrexia and the presence of Lancefield Group A haemolytic streptococci. In the tonsils there were variable degrees of hyperplasia. Included in this group are four cases of scarlet fever, one in an adult. No salicylates, mouth-washes, or any other treatment was given. The response will again be described under two headings.

Clinical.—The majority of patients became afebrile within 24 hours and all were afebrile within 48. There was great relief of local symptoms within 24 hours. This was particularly marked in a severe case of scarlet fever in an adult, who was taking solid food 24 hours after the beginning of treatment, in striking contrast to the controls, who were being treated with serum and sulphonamides.

In view of the small number of cases definite conclusions cannot be drawn, but the results certainly seemed to be better than could be accounted for by the chance selection of cases which happened to improve more rapidly than the normal. The results have, however, appeared striking enough to warrant further work being carried out, and it is hoped shortly to issue a report on a larger series.

Bacteriological.—In 7 patients haemolytic streptococci were no longer demonstrable 24 hours after treatment had started. In a further 6 they were no longer demonstrable after 48 hours. Of the remaining 4, of whom three had scarlet fever, one became negative only after six days, while the others possessed small numbers of haemolytic streptococci during the whole period of treatment and after it had finished, although the pyrexia had gone in 48 hours and the throat felt normal. The penicillin sensitivity of the organisms in these particular patients was comparable to that found in the others.

It is of importance to mention that in all these cases the usual technique of inoculation often failed to demonstrate

the presence of haemolytic streptococci after treatment with pastilles had been initiated, and it was possible to show that they were present only by what would be ordinary standards be considered gross over-inoculation. As previously stated, plates in which penicillinase was used were identical with those in which it was not used.

3. Chronic Streptococcal Throat Carriers

Twelve patients, all asymptomatic but proved by culture to be chronic carriers, were treated with pastilles given over a period of five days. Since they did not show any symptoms or noteworthy signs, the bacteriological results only will be discussed.

Bacteriological.—Of the 12 patients, seven gave negative cultures within 24, three within 48, and two within 72 hours. Two still show no haemolytic streptococci a month and six weeks respectively after cessation of treatment; one who became negative after 48 hours has not been seen again, and the remaining nine became positive within 1 to 15 days after stopping treatment, the average being 6 days. It was evident from these results that carriers could be kept clear while having pastilles, but that in the great majority of patients the organisms returned soon after cessation of treatment.

That the pastilles might be of some value even in carriers was shown by the case of a medical student who was known to be a carrier but who was unwilling to part with his tonsils. The presence of Group A haemolytic streptococci was not compatible with midwifery, and an attempt was therefore made to eliminate the organisms with a course of pastilles. Cultures became negative within 24 hours, but were positive again a few days after cessation of treatment. This result was repeated with a second course of pastilles, and it was decided, in consequence, that although his throat was a potential menace without pastilles, with them it was safe, and he was allowed to finish his course by taking them before and during deliveries.

4. Operations in the Mouth and Lesions of the Oral Cavity involving Loss of Surface

Three cases of fracture of the mandible compound into the mouth, two of difficult dental extraction involving considerable trauma, three of ulceration of the mucous membrane unassociated with Vincent's organisms, and three post-tonsillectomy cases have been treated. While these are too few in number for any definite conclusions to be drawn, certain facts are suggestive.

Fractures of the Mandible Compound into the Mouth.—All three patients with fracture of the mandible showed fractures at the region of the junction of the ramus and body of the mandible, and in one the fracture was bilateral. They were first seen 2, 5, and 15 days respectively after the original injury, had received no treatment at all, and all showed fractures compound into the mouth with displacement of the posterior fragment, and gross sepsis in the region of the fractures. All had marked external swelling over the fracture area and intense oral fetor, while one seen for the first time 15 days after injury showed a marked ulcerative gingivostomatitis associated with Vincent's organisms dating from the injury. Smears and cultures taken from the fracture line revealed many extremely penicillin-sensitive anaerobes. Within 24 hours of starting treatment the intense fetor had gone and patients stated that the mouth felt "cleaner." Cultures taken from the fracture line at this point were sterile in two cases, and in the third case yielded a small growth of *Haemophilus influenzae* only. Forty-eight hours after starting treatment cultures were negative in two patients and showed coliforms only in the third. The spirochaetes and fusiform bacilli present in the patient with associated ulcerative gingivostomatitis were entirely absent after 48 hours. Fixation and splintage of the mandible was carried out 24 hours after admission. In all patients the external swelling and oedema subsided at the end of a week. Two fractures have united firmly without incident, and the third appears to be uniting, though as only a fortnight has elapsed since the patient's admission the final result is not yet assured. In no case did local abscess formation occur.

Difficult Dental Extraction with Associated Trauma.—In two patients in whom lower molar teeth were extracted under regional novocain analgesia carious crowns broke off and

elevators were used for extraction of the roots, causing damage to the bone and tearing of the gum. After the extractions the patients were given pastilles and were forbidden to use mouth-washes. In both cases the blood clot remained *in situ* as in an uncomplicated extraction and the gum healed rapidly without sloughing.

Ulceration of the Oral Mucous Membrane unassociated with Vincent's Organisms.—Three patients have so far been treated. Two showed large single painful ulcers inside the lip, and one had large multiple ulcers over the area of the uvula, lips, tongue, and cheeks. In the latter the ulcers had recurred over a period of 14 years, the Wassermann and Kahn reactions were negative, and the blood count was normal. Of the first two patients, one had a pure growth of pneumococci from the ulcer, and the other a mixed growth of pneumococci and haemolytic streptococci, with the former predominating. In the first two patients cultures were sterile 24 hours after the beginning of the treatment. The ulcers were healed in six and eight days respectively. In the third patient haemolytic streptococci and pneumococci were present in large numbers in the ulcerated areas of the uvula, lips, and tongue. No organisms could be demonstrated in any of these areas 24 hours after treatment had begun. During the next 10 days coliforms only were present. With the exception of one small area on the tongue, the ulcers were healed at the end of a fortnight, and coliforms alone were found in the cultures of the remaining area for one week after cessation of treatment. The patient was then sent on three weeks' leave. On return, three more ulcerated areas were present, and these proceeded to increase in size until the condition was very much as it was when first seen. Haemolytic streptococci and pneumococci were again present in large numbers.

Post-tonsillectomy.—Three patients have been treated. In two the tonsillar beds were sterile after 24 hours' treatment; they then started to show coliforms, *N. catarrhalis*, and *H. influenzae* in the cultures on the third and fifth days respectively. Both healed rapidly, with a reduction in the usual slough. The third yielded a profuse growth of haemolytic streptococci from the tonsillar beds after operation. These were greatly reduced in numbers after treatment for 24 hours, and were absent after 72 hours.

Conclusions

Penicillin included in a pastille under suitable conditions of manufacture is liberated in the mouth in an active form. The concentration in the mouth can be maintained and the pastille kept for a period of at least three months without appreciable deterioration or loss of efficiency of the penicillin. It is simple to use and is well tolerated even by children. (The youngest patient receiving pastilles was aged 5.)

Acute ulcerative gingivostomatitis (Vincent's type) can be treated more simply and more quickly with the use of penicillin pastilles than by any other method. In addition, the loss of tissue caused by the more usual treatments with caustics and escharotics can be avoided. It is not suggested that gingivectomy or other procedures to eliminate the gum pockets and stagnation areas will not be necessary at a later date, since, while these pockets and areas remain, the possibility of recurrent infection is always present. The treatment described is advocated in the acute stages, and the fact that no recurrences have been seen over a period of three and a half months suggests that immediate recurrence is unlikely. In view of the fact that intravenous arsenicals are still widely employed in the treatment of the disease in spite of much evidence to show that it is ineffective, we consider that it is worth drawing attention to the fact that three of our most severe cases have been undergoing treatment for syphilis with injections of bismuth and intravenous arsenicals.

Patients with acute haemolytic streptococcal tonsillitis, including four with scarlet fever, seemed to respond clinically to treatment with pastilles. The effect on the throat flora appeared to be rapid, but, even so, a larger series of cases is necessary before any final conclusions can be drawn. The early disappearance or reduction in numbers of haemolytic streptococci in the throat after treatment had started suggests that the risk of droplet infection is greatly reduced, and we regard this point as of importance epidemiologically.

The treatment of throat carriers of haemolytic streptococci proved disappointing, as was anticipated. Nevertheless it is of interest that they became negative while undergoing treatment, and, in the case of the medical student described, this fact proved of practical value.

In the small series of patients so far treated it appeared that surgical conditions of the mouth and throat could be kept free from pathogenic organisms during administration of the pastilles, with marked symptomatic relief.

On bacteriological grounds faucial diphtheria should be an indication for treatment with penicillin pastilles. Unfortunately we have as yet been unable to obtain suitable cases, but it is hoped to publish these results later in a fuller report.

We would like to express our gratitude to the Penicillin Clinical Trials Committee of the Medical Research Council and Prof. L. P. Garrod for providing the penicillin which made the investigation possible, and to the latter for his encouragement and helpful criticism. We are indebted to Miss G. E. Root for grouping the streptococci and cheerfully accepting other onerous duties. We would also like to thank Dr. Paton, the matron, and staff of the Sisters' Hospital for Infectious Diseases, St. Albans, for their kind co-operation; Lieut.-Col. O'Connor, and Captains Battson, Fairhurst, and Patterson of the Army Dental Corps for their help in referring cases of ulcerative gingivostomatitis to us; and many members of St. Bartholomew's Hospital Staff at Hill End E.M.S. Hospital, St. Albans, for kindly allowing us to treat their cases. We are greatly indebted to Mr. L. T. Martin, of the dispensary, Hill End Hospital, for making the pastilles.

AN ANALYSIS OF 259 OF THE RECENT FLYING-BOMB CASUALTIES

BY

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This is an attempt to present a picture of the recent flying-bomb raids as seen in a small E.M.S. hospital. For those interested in figures I have included tables. We admitted anyone requiring treatment that the rest centres could not provide. The selection was quite varied: by no means all our patients needed dramatic surgery to staunch a sea of blood, and some of our bizarre cases presented interesting problems. Not the least was a poor soul who had been blown into a tank of dirty industrial oil and appeared in the midst of a rush of casualties: we used our gas-decontamination centre for the first—and we hope the last—time.

In order to keep on admitting every day, every night—sometimes several times in the same night—we convoyed our patients as soon as they were fit to travel. Convoying has its own advantages and disadvantages. The former are obvious in the large turnover possible; the latter only appear later. We became the first cog of a large wheel: we admitted; we provided immediate treatment; we darned and patched and then transferred our patients at the first possible moment, accompanied by only brief notes. Continuity of treatment is bound to suffer, and it is very difficult to estimate the success and failure of one's efforts. This is the great weakness of the service. Some of our cases went as far afield as Wales: of their progress we knew nothing until discharge notes—quite as brief as ours had been—came trickling in. Later still a few of the patients themselves began to arrive as out-patients for review, but many have fallen by the wayside. There are great gaps in the story—inevitably so; some so gross that I wondered if it were possible to hold the interest with our jumbled facts and many loose ends; but I felt that if each link in the chain were pieced together—the casualty hospital, the base hospital, the ambulance trains, the distant evacuation centres—the story would be worth while.

In all we dealt with 222 out-patients and 259 in-patients, with 18 deaths. Our story began in June, 1944, when the first large incident occurred near by. Twenty-six casualties were admitted and 12 required theatre treatment. This proportion remained fairly constant throughout the series. Altogether we had 83 theatre cases out of 259 admissions, and had to send 35 cases on untreated, most of whom required the theatre. In this first incident no fewer than 16 of the casualties were

due to flying glass. It was noticeable how the proportion of glass injuries dropped as the importance of taking adequate cover was realized, while the percentage of crush injuries increased from people being trapped by falling masonry.

In July we admitted 32 patients from a neighbouring hospital which had been hit, only to send them on in a few hours, to the great grief of the nursing staff, who had just succeeded in disentangling prostatic tubes from false teeth and restoring order out of chaos.

A night in July began our peak period. We admitted 24 cases, 6 requiring theatre treatment. Next morning, at 10 o'clock, a flying bomb dropped in a near-by market-place. The incident caused the highest number of casualties of the whole London attack. We admitted 74 to the wards and dealt with over 90 in the casualty department. At one time we had ambulances evacuating the night's casualties waiting their turn with ambulances bringing fresh wounded. In 24 hours over 100 patients were wards. This is the brighter side of the convoy system. As we could not deal with all the cases in our single theatre in reasonable time we re-evacuated 35 patients after rest, cleaning, and first-aid attention, and 15 more who had had minor operations. The most gravely injured we retained. In the tables T refers to the transferred cases, and any remarks about them are more liable to error since only a clinical diagnosis was made at the bedside and was unsupported by further investigations.

So much for the conditions. It was impossible to obtain complete accuracy when the cause of every death could not be proved by necropsy and some of the cases were whisked away with only a partial diagnosis.

Air-raid casualties may be divided into two great groups: (1) those who require surgical treatment, and (2) those who do not.

GROUP 1: REQUIRING SURGERY

These cases are best described in reference to the agent which caused the injury. Any patient may fall into more than one such category.

A. Flying Glass

This was the most frequent cause of injury, totalling over 100 casualties in all. Many included severe damage to the eyes. It is noticeable that most of the injuries were above the nipple line, chiefly of the face and neck: a large proportion were received when looking out of windows—a modern version of curiosity killing the cat. We had five cases of perforating wounds of both eyes and ten perforating wounds of one eye. The globe was usually completely destroyed. Many of these injuries were avoidable, and therein lay their great sadness.

The penetrating power of flying glass is, in the main, low. It is unusual for it to pierce the deep fascia: usually it lies just under the skin in the fat, but when present in hundreds of pieces it presents a problem which has not yet acquired a satisfactory solution; nor has the condition made its way into the textbooks of war surgery. Often the gashes are also begrimed with earth, wood, and stones: orthodox surgical toilet is an impossibility, or at least ill advised. We had two outstanding examples of this condition, which may stimulate interest and which are quite comparable in that the wounds were of roughly the same intensity and situation and both patients were very bad surgical risks—fat, heavy, and chronic bronchitics.

Case I (Miss X., aged 58)

This patient was admitted on June 23 suffering from compound fracture of the medial epicondyle of the left humerus, with surrounding destruction of skin and subcutaneous fat for an area of three-quarters of a square foot on the posterior surface of the arm. There was a similar wound on the posterior surface of the right arm, except that it was without bony injury. Her back was lacerated by flying glass—there were probably 100 cuts in all. On admission she was barely conscious, with a blood pressure of 90/70, and her pulse was scarcely perceptible. She was treated for shock by morphine, rest, hot-water bottles, and hot sweet tea. She was given A.T.S. 3,000 units and A.G.G.S. 4,000 units. An attempt to administer intravenous fluids by the legs failed owing to previous extensive ligation and injections for varicose veins, and her arms were unsuitable for intravenous therapy because of the many cuts. Some six hours after admission her condition had considerably improved; blood pressure had risen to 110/80, and she was quite rational and complaining of pain. She was taken to the theatre,