SOME CONTRIBUTIONS TO WAR SURGERY FROM THE U.S.S.R.*

BY

RUSCOE CLARKE, M.B., F.R.C.S.

First Assistant in Surgery at the British Postgraduate Medical School

War surgery is the continuation of the surgery of peace under somewhat different conditions. War demands adaptations, modifications, and development of technique and organization. It stresses the importance of some fields of surgery at the expense of others. It should be possible, however, to get some idea of the capacity of the surgical services of a State to react to war conditions from a study of their functioning in times of peace. I shall therefore introduce a description of the work of certain Soviet institutions, the consideration of which should lead us to expect from the Soviet Union a high standard of war surgery. At the same time it is important to consider developments in Soviet surgery in their relation to progress elsewhere, to the general evolution of surgical knowledge and technique. Our past ignorance must not allow us to regard Soviet surgery as something peculiar. Up to a point methods of research are similar and work advances along orthodox channels. We have to see the similarities as well as the differences.

As a start, then, I shall refer briefly to the past. It is impossible to assess the importance of what is happening to-day unless we can achieve some sense of historical perspective. Nowhere is this fact so well recognized as in the Soviet Union. The new Soviet State has been continually alive to the need to preserve the best from the past. Great attention is paid to the work of early pioneers and outstanding individuals in the history of science.

Historical

In this connexion one man stands out in Russian history—Nikolai Ivanovich Pirogoff (1810-81). He is regarded as the founder of Russian surgery. His chief individual contributions were concerned with wound infections in hospitals, ether anaesthesia, and the details of the organization of surgical aid for the wounded in war. It is claimed that he was the first to introduce the plaster wound dressing into military field practice, in the Crimean War in 1854 (Shmarevich). He recommended plaster as the best dressing for amputation stumps in 1855 and advocated the windowless plaster cast for open gunshot wounds of the legs. Pirogoff was a great man, and in the French literature has been compared to Ambroise Paré himself. No insignificant monument to him remains in the Military Academy of Medicine in Leningrad, which he developed into the finest school in the country. The school has continued, and only recently has produced important studies on the prevention and treatment of painful amputation stumps and scars by the early injection of novocain (Astvatsatourov, 1938).

Worthy upholder of the best traditions of the past and a link between the past and the future is Nikolai Nilovich Burdenko (see reference: VOKS), head of the Neurosurgical Institute, member of the Academy of Sciences, awarded the Order of Lenin for outstanding services in the field of surgery, active as President of the Medical Council of the People's Commissariat for Health, Chairman of the All-Union Association of Surgeons, and Deputy to the Supreme Soviet of the Union of Soviet Socialist Republics. Here is a man who obtained his initial experience and training before the revolution but has since been able to develop his work in all spheres of surgery. Recently his

attention has been concentrated upon the establishment of a Russian school of neurosurgery. But his life's work has ranged over many fields in anatomy, physiology, experimental surgery, pathology, and general surgery. He is responsible for original work relating to the surgery of the lungs, gastric ulcer and carcinoma, shock, etc., as well as in the more limited field of neurosurgery. In addition to all this he is one of the outstanding experts on military hygiene and surgery, and his book on military field surgery is regarded as a classic.

Soviet Institutions

Typical of the best in the organization of Soviet medicine and directly relevant to a study of Soviet preparedness for war surgery is the Central Emergency Hospital in Moscow (the Sklifasofsky Institute) (1937) (Sigerist, 1937; Band, 1937-8). The Moscow district is served by five emergency motor ambulance stations, one of which is placed centrally at the institute, where there is a special telephone exchange. Urgent calls are received here, and the central station is responsible for sending out ambulances to accidents and cases of sudden illness.

There are two types of ambulance service. The first is for emergencies such as street accidents, factory disasters, and sudden collapse, and for genuine surgical emergencies when the call comes from a doctor prepared to make a definite diagnosis. The ambulance is sent immediately, and the medical and surgical staff are informed so that full preparation can be made. If a delay of more than two minutes occurs before the ambulance leaves the hospital an inquiry is held. The second type of service is used when a call is put through by relatives or strangers—if the case sounds convincing but is clearly not so urgent. Such cases have to wait their turn for a car, which will probably be sent within two hours. When the case is not considered by the doctor on telephone duty to come under this category the station recommends that a local doctor be called in, and gives the telephone numbers of local doctors and of the nearest hospital. It is important to note that no doctor is employed on the staff of the institute who has been qualified less than ten years. Long years of practice have made it possible to elaborate a series of leading questions and other means of eliminating serious error from this system of telephone sorting. In 1936 this ambulance service made 59,156 trips. The number of beds available is about 700, of which more than half are surgical. The medical staff numbers 100, with another 70 available for shifts on first-aid duty. The concentration of cases allows the surgical staff to amass a wide experience. Adequate records enable this material to be available for study and assessment of the results of different techniques (Grey Turner, 1938).

The most remarkable surgical work of the institute, apart from the original work on stored cadaver blood, is that of Prof. Judin. During a nine-year period 1,400 perforated peptic ulcer cases came under the care of his unit. Of these, 75% were treated by partial gastrectomy. In 1933-4 the mortality figure for gastric resection in 331 perforated ulcers was 7.8%. Prof. Judin is also an advocate of early resection in bleeding ulcers, claiming a total mortality of 4.4% for all gastric resections performed in the institute. The main factor responsible for these results is the organization which makes early operation possible in a high proportion of such cases. Mr. David Band (1937-8), in an account of his visit to the institute, expresses his surprise and interest that under a State medical service "it was possible for an emergency surgical specialist to extend his sphere of work to include not only the whole field of gastric surgery but in addition the many-staged plastic operations necessary for the rehabilitation of cases of oesophageal stricture subjected by him to emergency gastrostomy." We can only hope

* A paper delivered at a meeting held on July 25, 1941, at the Medical Society of London under the auspices of the Society for Cultural Relations with the Soviet Union.

that at this present time the Moscow Casualty Services have been developed along similarly efficient and elastic lines.

A second institute, of a rather different type, illustrates the planned clinical research into the treatment of injuries. The Leningrad Traumatological Institute (Dott, 1937-8), with only 80 beds, is the centre for this research throughout the Union. It has a statistical department which assembles and studies figures for injuries incurred in various industries—in agriculture, transport, etc. The results are passed on to the Commissariat for Health, which is able to proceed with energetic steps for the removal of remediable causes. Key clinical problems—e.g., some particular type of fracture—are selected for special study, and cases of this type are concentrated at this institute. When completed the results are published in pamphlet form and sent out to all the hospitals in the Union. A system of orthopaedic clinics linked with the main hospital extends its sphere of influence and helps to provide clinical material. Postgraduate teaching is an important feature of the institute.

Here, then, we have two examples of specially planned institutions, working as an integral part of the general medical organization. I think we can assume that the adaptation of such hospitals and teams of experts to war surgery should not be difficult.

I propose now to deal with examples of recent Soviet contributions to war surgery which illustrate among other things the planning of research and the provision of opportunities for full clinical trial of the results of such research.

Local Anaesthesia

The struggle to perfect the technique of local anaesthesia has stimulated the development of surgery since the days of Halsted's original work. The use of local anaesthesia for major surgery demands a high degree of surgical skill, with particular need for gentleness and delicacy, such as characterizes the modern school of neurosurgery founded by Harvey Cushing, himself a product of the Halsted school. In recent years the range of possible use of local anaesthesia has been extended. Finsterer developed its use in gastric surgery, and Ogilvie has popularized his methods in this country. Böhler demonstrated its value in closed and open fractures. Many surgeons have increasingly extended its application, particularly as proposed by Crile in association with some form of general anaesthesia sufficient to produce unconsciousness.

The Soviet contribution in this field is threefold: (1) a new technique; (2) the new application of a new drug; and (3) the demonstration of the practicability of using local anaesthesia in all types of cases, even under war conditions.

The new technique was originated by Vishnevsky (1938). Injecting large quantities of a weak solution (equal parts of 0.25% novocain and 1/4,000 percaine), he takes advantage of the normal anatomical fascial pockets surrounding muscles, viscera, etc., to get wide diffusion of the drug and rapid contact anaesthetization. Each aponeurotic layer is left intact until the underlying fascial compartment has been distended and anaesthetized. The fascial and aponeurotic anatomy of each region needs to be understood so that wide anaesthesia may result from a single continuous spreading infiltration from a chosen point. This technique of spreading infiltration can, it is claimed, be used everywhere except for the head and the extremities of the limbs. Vishnevsky describes in detail its application to the thyroid, to breast cancer and ventral hernia, abdominal cavity, biliary tract, renal fossa, and limbs. In the case of the fingers and toes a variation is used. Isotonic solutions are employed, and the soft tissues at the base of the digits are distended at first so that the risk of gangrene from circulatory interference is avoided. An important effect claimed is the minimization of post-operative shock. Already in

1938 Vishnevsky proposed that this technique should be tried out under war conditions. He quotes Crile's figures for major amputations during the 1914-18 war as illustrating the great reduction in mortality following the introduction of local anaesthesia. These conclusions are fully substantiated by the reports of Henry (1940) and Abdelsamie (1936) of their experience in the treatment of major limb crushes at Cairo. Vishnevsky goes further. He claims that the use of local anaesthesia by his technique is perfectly safe in the presence of local sepsis.

So much for the method. Stimulated by this, Synovich (1940) has carried out a series of clinical experiments using a Soviet preparation of percaine (sovkain) in increasingly dilute solution for local infiltration anaesthesia. He claims that it is fully effective at a strength of 1/10,000. It is suggested that at this dilution it is safe to use up to 25,000 c.cm. Actually no more than 1,000 c.cm. was used for one operation. Complete skin anaesthesia is attained within one to two minutes and is maintained for four to six hours. Deep infiltration produces immediate anaesthesia. No toxic reactions were reported.

The next stage is represented by the reports of Novikov (1940) from Moscow. He discusses 3,180 emergency operations, 98% of which were performed under local anaesthesia. Ages varied from 3 to 83; 37.5% were traumatic cases. Sixty-five cases of penetrating wounds of the abdominal cavity were treated, with a mortality of 36.8%. This compares favourably with a mortality of 55% for similar cases during the Lake Hassan incident. One hundred and fifty-four major amputations were performed under local anaesthesia, with a mortality of 14.7%, as compared with Akbutin's figure of 18.7% at Lake Hassan and 22.8% given by Belkin as the general mortality for all amputations of the lower limb in the Ukraine. The technique used was that of Vishnevsky. The trial of this technique under war conditions was carried out by Pschenichnikov (1940) and a team of surgeons during the Finnish campaign. A large series of unselected casualties was operated upon under local anaesthesia side by side with other surgeons working with general anaesthesia in two-table theatres. They were able not only to demonstrate the possibility of using local anaesthesia under these conditions but to refute the objection that this would mean an unnecessary lengthening of the operating time. They showed that such delay can be avoided even in cases with multiple injuries. Their cases were fit for evacuation much earlier than the others. The decrease in post-operative shock is stressed and the preliminary anaesthetization is regarded as part of the pre-operative treatment of shock. Thus many of the theoretical objections to the use of local anaesthesia in war surgery have been removed.

Electrical Trauma

The most comprehensive recent survey of this subject is contained in a lecture given by Kaplan (1940) of the Moscow Town Health Department for the Study of Electro-trauma. Modern military technical equipment makes wide use of electric power. Soldiers are exposed to danger of injury from electric current from their own power stations as well as from electrified wire entanglements and other new electrical means of attack and defence. Pathologically and clinically it is essential to realize that the external evidence of trauma is only a small part of the picture. All the tissues of the body, particularly the blood vessels and the nervous system, are exposed to a severe disorganizing influence. An important practical effect of the deep-seated nature of the disturbance is the long duration of treatment and the need for evacuation of any but the most trivial cases. Within two or three weeks the area of apparent damage

may have extended to twice or three times the original size. A surrounding zone which at first seemed likely to survive becomes necrotic. The base of a blister breaks down and becomes a deep ulcer. Adjacent blood vessels are involved in this necrosis, and severe secondary haemorrhages occur between the third and fourth weeks. Bone involvement results in slowly separating sequestration. Systemic reactions are varied and complex. Death may be instantaneous or may follow a short period of respiratory difficulty, haemorrhage, and cerebral disturbance. A condition of so-called "pseudo-death" is described, with cessation of heart-beat, respiration, and all reflex and nervous activity, without cellular death. Rapid active resuscitation may result in recovery. The onset of the condition may follow a latent period of a few hours.

The scope of first-aid treatment obviously depends upon local conditions. Where the shock is received during military operations it is clearly impossible to give prolonged treatment on the spot. The urgent need is for speedy evacuation. For this purpose a tank with a trap-door in the bottom has been devised. This moves over the casualty so that the man lies between the caterpillars, and can be lifted through on to a bed, where treatment is begun. Immediate treatment usually involves artificial respiration. Stimulant drugs may be given intravenously. Resistance to chilling is low. Cyanosis may require venesection. Severe circulatory collapse may respond to transfusion. Should there be no sign of life the patient must not be given up as dead until visible signs of death appear or stiffness sets in. Movement should be avoided if conceivably possible. A possible addition to routine restorative measures is the electrical stimulation of the phrenic nerve by application of an electrode over the lower part of the sterno-mastoid.

Treatment of external injuries is similar to that for thermal burns. Even the smallest marks, however, require full cleansing and application of coagulants, since these may become macerated and septic as a result of the excessive sweating. Primary amputation is generally inadvisable. It is difficult to define the limits of necrosis. Blood vessels are rigid, bleed violently, and tear across when forceps or ligatures are applied. Stumps become septic and the infection spreads rapidly.

Chest Wounds

[An account of recent British work in this field is omitted for lack of space. The reader is referred to the discussions (1940a, 1940b) held at the Royal Society of Medicine and to the *Bulletin of War Medicine*, 1941, No. 5.]

The available Soviet material in general confirms recent British experience but reveals a number of interesting new aspects. Papers by Linberg (1940) and Matseyev (1940) are based on a series of 972 casualties from the Finnish front treated at a special military hospital for chest wounds between November, 1939, and May, 1940. These included 263 with open pneumothorax and 96 with closed haemothorax. In 97 cases these chest wounds were complicated by severe injuries elsewhere. The total fatalities were 29 (3%). Of these, 12 resulted from severe combined thoracic and other injuries, including 5 cases of gas gangrene. The remaining 17 were from the effects of the chest wounds alone. Comparison with other figures is difficult on account of the very different stages at which these patients reach hospital. Ranson, an American surgeon working at Shanghai, gives mortality figures for chest wounds in hospitals for some of the various wars of the past century:

English Army in the Crimean War	..	79.2%
American Army in the Civil War	..	62.6%
German Army in the Franco-Prussian War	..	24.5%
English Army in the Boer War	..	14.0%
English Army in the 1914-18 War	..	27.5%
Chinese hospital at Shanghai, 1937	..	14.8%

The low figure for the Boer War is attributed to the climate and to the high proportion of bullet wounds. The last figure is explained by the fact that the cases with severe wounds did not reach hospital at all. Burdenko carried out a differential analysis of the fatalities from chest wounds on all fronts during the 1914-18 war. He gives a general mortality of 60 to 80%, reduced at primary hospitals to 30 to 40% and at base hospitals to 15 to 35%. In the light of such figures the present series merits careful study. Of these cases 2.5% reached hospital on the first day, 53% between the second and fourth days, 24% between the fifth and seventh days, and 20.5% between the eighth and twentieth days. Wounds of the thoracic wall and uncomplicated bullet wounds of the thoracic cavity gave little trouble and require no special comment.

Bullet and shell wounds with open pneumothorax constituted the most serious group. The 17 deaths from chest wounds alone came under this heading, comprising 6% of 263 cases. Of these, 246 (94%) had been sutured and only 17 extensive wounds left open. In the majority the muscle only had been sutured. Where the skin had been closed, spreading infection and surgical emphysema had developed. No previous operation had been carried out on the lung or pleural cavity. The chief problem in these cases of wide-open pneumothorax is that of keeping the wound closed and avoiding mediastinal flutter. Aspiration of all collections of blood prevents wound disruption from pressure. The lung is drawn out into contact with the chest wall and adhesions can occur. Where this happens residual accumulations can be dealt with as indicated. Where adhesions fail to form the wound is sealed by overlapping watertight strapping. In this group a number of operations were necessary for the removal of foreign bodies. Attempted suture of the lung when infection was established was found to be unsatisfactory.

Stimulated by this experience, Verhovich and Ignatovskaya (1940) carried out an extensive series of animal experiments. Their conclusions may be summarized as follows: (1) Either the thoracoscope or the cystoscope may be used with advantage in the exploration of open wounds of the thoracic cavity. (2) Increasing haemorrhage should be dealt with by lung suture and pneumopexy. (3) Where this is impracticable valvular suction drainage should be substituted. (4) Suture of the wound around a drainage tube with a 5-mm. orifice did not prevent the onset of severe symptoms. (5) Substitution of a tube with a 2-mm. orifice brought about improvement and allowed further exploration within twenty-four hours. (6) Mattress sutures produce necrosis of the lung tissue and should be avoided. On the basis of this work and of the general experience of the hospital, instructions were issued to those working in the advanced posts to attempt more radical primary intervention wherever possible in open pneumothorax.

The other important group, discussed particularly by Matseyev (1940), consists of the cases of closed haemothorax. Until recently these had been treated conservatively, but existing evidence suggests that early aspiration is the treatment of choice. Complete evacuation of the blood by repeated aspirations under radiological control is begun on the third or fourth day. This is combined with irrigation with mild antiseptic solutions—chloramine 1/500 or rivanol, 50 to 100 c.cm. This technique is substituted for air replacement on the basis of clinical and experimental evidence. Of the 96 cases only 2 became infected, and there were no deaths. Much of the general success obtained in this series is attributed to the fact that 65% of the cases were transported from the front by air. The condition of these, including many of the most severely wounded, was far and away better than that of those brought back by road. Other factors besides that of efficiency of organiza-

tion suggested as explanations of the excellent results were: (1) the magnificent state of health of the soldiers; (2) the predominance of bullet wounds; (3) correct treatment.

Another contribution to the surgery of chest wounds consists of a report to a conference of evacuation hospitals by Achutin (1940). It covers all chest wounds in the war zone during the Finnish campaign. No adequate justice can be done to this contribution in the space available, and only a few of the more important conclusions will be mentioned. With reference to the recommendations of Prof. Linberg, referred to above, Achutin admits that up to the present the problem of major surgical intervention in the war zone for open wounds of the chest has not been solved. Satisfactory results have been obtained only when cases have been seen within one to two hours and when the lung could be seized through the wound, sutured, and fixed to the parietes. Personal observations have led him tentatively to advocate the trial of vago-sympathetic novocain block as additional treatment for shock. The report reiterates the importance of air transport and of the different attitude which can be adopted towards these cases where such transport is available. This was especially important during the campaign in the far north, where the intense cold produced a high incidence of pneumonia, which developed about the fourth or fifth day. Evacuation after recovery from the initial shock and before the time of onset of these chest complications would appear to have been almost ideal.

Congratulating Prof. Linberg and the special unit on their magnificent work, Achutin points out that the total mortality is still high. As many as 40% of chest-wound cases do not leave the battlefield, while 20% of these patients die before the base hospital is reached. The solution of this problem requires the full application of all the available organizational, experimental, and clinical experience.

Conclusion

The march of history has done much to sweep away the veil of distrust which has separated the people of Britain from the people of the Soviet Union. I hope that this meeting will serve three purposes: first, to begin the removal of that prejudice and ignorance which has interfered with our understanding of the development of Soviet medicine and surgery; secondly, to help to get an understanding of some of the things which the Soviet people are fighting to defend; thirdly, to obtain some ideas for the improvement and reorganization of our work here.

Whatever success we may have to-day can only be a beginning. British medicine has much to contribute to the exigencies of this common struggle. We have a great deal to give, but we have plenty to learn.

REFERENCES

- Abdelsamie, L. (1936). *Lancet*, 1, 187.
 Achutin, M. N. (1940). "Treatment of Chest Wounds in the Army Zone," July, 1940 (unpublished).
 Astvatsaturov, M. I. (1938). *Acta med. U.R.S.S.*, 1, 9.
 Band, David (1937-8). *Trans. med.-chir. Soc. Edinb.*, 52, 57.
 Central Emergency Hospital, Moscow (1937). *Brit. J. Surg.*, 25, 446.
 Discussion (1940a). *Proc. roy. Soc. Med.*, 34, 83.
 — (1940b). *Ibid.*, 34, 73.
 Dott, Norman M. (1937-8). *Trans. med.-chir. Soc. Edinb.*, 52, 44.
 Henry, Arnold K. (1940). *Lancet*, 1, 736.
 Kaplan, A. D. (1940). *Sovetsk. Med.*, 4, 22. (Abstract in *Bulletin of War Medicine*, 1941, No. 5, p. 293.)
 Linberg, B. E. (1940). *Khirurgiya*, 9, 97.
 Matseyev, L. E. (1940). *Ibid.*, 10, 109.
 Novikov, G. M. (1940). *Ibid.* (Abstract in *Bulletin of War Medicine*, 1941, No. 3, p. 170.)
 Pshenichnikov, V. I. (1940). *Sovetsk. Med.*, 4, 34. (Abstract in *Bulletin of War Medicine*, 1941, No. 3, p. 170.)
 Shmarevich, N. B. *Ibid.*, 2, 40.
 Sigerist, Henry E. (1937). *Socialised Medicine in the Soviet Union*, p. 302, London.
 Synovich, I. M. (1940). *Khirurgiya*, 9, 70.
 Turner, G. Grey (1938). *British Medical Journal*, 2, 691.
 Verhovich, F. P., and Ignatovskaya, N. N. (1940). *Khirurgiya*, 10, 10.
 Vishnevsky, A. V. (1938). *Acta med. U.R.S.S.*, 1, 148.
 VOKS: "A Remarkable Physician," M K/4.*

* These and other Soviet publications are available in the library of the Society for Cultural Relations with the Soviet Union, 98, Gower Street, W.C.1.

THE REDUCTION OF HOSPITAL INFECTION OF WOUNDS

A CONTROLLED EXPERIMENT

BY

W. McKISOCK, M.S., F.R.C.S.

JOYCE WRIGHT, D.M.

AND

A. A. MILES, F.R.C.P.

(From an E.M.S. Neurosurgical Unit)

The demonstration by Miles *et al.* (1940) of a high incidence of hospital infection of wounds, and the recommendations formulated by them to reduce this incidence, were based in part upon investigations made on patients treated in this unit. It was thereupon decided to attempt the development of a dressing technique which would eliminate hospital infection as completely as possible.

Conditions of Experiment

The value of modifications in dressing technique was judged by the reduction of hospital infection observed in a four-months period from February 1 to May 31, 1941, as compared with a previous four-months period from September 1 to December 31, 1940. The intervening period of January, 1941, was excluded, since during this month the new dressing technique was being evolved and perfected.

In the two periods the underlying conditions were essentially the same. The clinical material handled was similar, consisting (1) of cases of head injury, mainly air-raided casualties whose wounds were infected at the time of admission; and (2) of neurosurgically clean cases, mainly intracranial tumours. The employment of chemotherapy was on the same basis during the two periods, and, finally, the personnel concerned with the dressing of wounds remained relatively unchanged throughout the entire eight months of the experiment.

The Improved Dressing Technique

The dressing technique here described was designed on the assumption that the main cause of hospital infection demonstrated in the first four-months period was the carriage of infected discharge from one patient's wounds to another's by members of the medical or nursing staff, settlement from the air and droplet infection being less important. Our aim was to combat the spread of infection in as simple a manner as possible—contact infection by the dressing technique itself, dust-borne infection by Rules 1, 2, and 6 in the instructions below, and droplet infection by Rules 3, 4, 5, and 9.

It was found impossible to reduce the dressing team to fewer than four persons unless dirty-dressing bins with foot-action lids could be procured. With this addition to the equipment the team could be reduced to a minimum of three. The first member of the team is the dresser, who begins his work when the bandage and outer dressings have been removed from the wound, finishing by applying the new bandage assisted by the "dirty nurse," after which he washes his hands and forearms and dries them on an ordinary towel. The "clean nurse" looks after the trolley and its contents only, touching nothing throughout the entire dressing round, and washing her hands and forearms only at the beginning and end of the series of dressings. The "dirty nurse"—an indispensable member of the team—removes the outer dressings and bandage and then stands by until the end of the dressing, when she assists in the application of the final bandage, afterwards washing her