

1941, and shortly thereafter with several civilian surgeons from Honolulu I began operating at a large military hospital. . . . The casualties were numerous, varied and severe. The majority were the result of bombing or machine gun attack. . . . Shock and hemorrhage were common, but these were surprisingly well combated by transfusion of blood or liquid plasma. . . . On arrival, the wounded were triaged (sorted) and given preliminary sedation of $\frac{1}{2}$ grain (0.03 Gm.) morphine when indicated. . . . Anesthesia was usually by gas-oxygen-ether sequence, the induction often preceded by intravenous evipal or pentothal sodium. The last named agents were often used throughout and in some cases were administered through a puncture into the transfusion or infusion tubing close to the bend of the elbow. Very few spinal, rectal or local anesthesia procedures were undertaken. . . . The state of well being of the wounded was exceptional after the first few days. Those in need of stimulation were given a transfusion. . . . Our greatest defect was inability to give better preoperative shock treatment to a larger number of the seriously wounded."

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PENDER, J. W., AND LUNDY, J. S.: *Anesthesia in War Surgery*. War Med. 2: 193-212 (Mar.) 1942.

"Since the first clinical use of ether as an anesthetic agent in 1842, some type of anesthesia has been used in the care of the wounded during most of the major conflicts. Prior to 1842 surgical technic was rather crude; in fact, in some primitive armies no treatment was attempted and the wounded were executed on the battlefield. . . . According to Dickson, the ideal anesthetic agent must be safe, portable, capable of being administered by the surgeon, rapid in action, usable with

simple apparatus, controllable, capable of being used without a supplementary anesthetic agent, without extrinsic risk, without contraindications, without serious after-effects, nonvolatile, certain of action and stable of storage. . . . Service patients usually are healthy, but frequently they are suffering from hemorrhage and shock, which, in addition to excitement, may cause them to vomit food eaten ten to twenty-four hours previously. Excessive use of tobacco, common among soldiers, may have some effect on the administration of the anesthetic agent and the frequency and severity of postanesthetic complications. Because of the increase in the speed of transportation and communication, the modern battle lines may extend from arctic to tropic climates, which necessitates the adjustment of anesthesia to the hazards of each. According to Routh, the art of inducing and maintaining general anesthesia among Europeans in the tropics has characteristics which are definitely different from those encountered in England. Because of their volatility, certain of the general anesthetic agents cannot be administered satisfactorily by the open method in hot climates. Special account may have to be taken of endemic disease, such as malaria, dysentery and scurvy, especially in relation to cardiac complications. . . .

"In war surgery the hazard of fire and explosion is increased, especially when ventilation of the operating theater is complicated by needs of blackouts and safeguards against gas. Stocks of drugs should be in multiple small depots to prevent destruction of the entire supply by a single bomb or shell. In rush periods, such as occur during and after a major battle, the disadvantage of the lack of preoperative medication may be overcome to some extent by the intravenous administration of morphine sulfate,

dihydromorphinone hydrochloride (di-
laudid), omnopon, scopolamine hydro-
bromide or pentothal sodium. . . .

"Although almost abandoned in re-
cent times, chloroform was the first
anesthetic agent to gain favor in mili-
tary surgery. . . . During the Civil
War, anesthetic agents were ascer-
tained to have been given 80,000 times.
Of 8,900 recorded cases in which the
anesthetic agent was indicated, chloro-
form was used in 76.2 per cent, ether
in 14.7 per cent and a mixture of
chloroform and ether in 9.1 per cent;
chloroform was used almost uniformly
in the field hospitals, while ether was
used more often in the general hos-
pitals. . . . Chloroform was the an-
esthetic agent either of choice or of
necessity in many of the British colonial
wars. . . . It was only during the
war of 1914 to 1918 that anesthesia
was used on a large scale in military
surgery. During this period chloro-
form did not lack for ardent advoca-
tors. . . . In spite of its recognized
toxic after-effects, chloroform has been
advocated for use in the present war
because of its noninflammable proper-
ties and its lack of bulk. . . . Ether
was first employed on the battlefield
by the great Russian surgeon, Piro-
goff, during the Crimean War. Later,
during the American Civil War and
the British Suakin expedition, it was
recognized as being entitled to a place
among the major anesthetic agents.
In the war of 1914 to 1918 it was used
extensively both by the open method
and as ether vapor. . . . In the litera-
ture pertaining to the present war,
ether has been recommended rather
consistently for use in casualty-clear-
ing stations, hospitals and trailer
operating rooms. It is especially indi-
cated in cases of intra-abdominal in-
juries. Various mixtures of chloro-
form and ether or chloroform, ether
and ethyl chloride were used for more

quiet and quick inductions in the war
of 1914 to 1918. . . .

"Local anesthesia has been advised
for war injuries treated in the hospi-
tals as far forward toward the line
of battle as the casualty-clearing sta-
tions, in battleship dressing stations
and in sick bay on board ship. The
most generally accepted indication for
local anesthesia is the presence of
shock and sepsis, and it is also recom-
mended for the prevention of shock.
. . . . Because of the simplicity of its
induction, local anesthesia has proved
to be valuable for minor operations,
sympathetic block for treatment of
frostbite, treatment of fractures,
sprains, muscular contusions, trau-
matic synovitis, acute and subacute
bursitis, somatic pain and pleural pain.
The advantages of local anesthesia
over other methods are as follows: It
is safer, is more rapidly induced and
produces less shock; fewer assistants
are needed to induce it; pain is absent
after it; the patient can take nourish-
ment immediately after it; conva-
lescence and recovery are quicker; there
is no fear of the anesthesia; handling
of tissue and danger from sepsis are
less; the mental attitude of the patient
is better, and postanesthetic compli-
cations are less frequent. . . . Local
anesthesia has been frequently advoc-
ated in the literature concerning
military anesthesia. . . . Nitrous oxide
was first used as an anesthetic
agent for military purposes in the war
of 1914 to 1918 and rapidly gained the
respect of many anesthetists. . . .
The greatest disadvantage of using a
mixture of nitrous oxide and oxygen
as an anesthetic agent is the bulk and
complexity of apparatus necessary for
its administration. . . .

"As early as 1909 and 1913 spinal
anesthesia was advocated as a routine
procedure preferable to inhalation
anesthesia in military surgery. It in-
creased in favor during the war of

1914 to 1918 and the recent Spanish Civil War, and it has been predicted that it will be used more than ever in the present war. . . . The advantages of spinal anesthesia over other methods are that the period of hospitalization is reduced and, less nursing attention is required, the period of convalescence is shorter, the laryngeal reflex is preserved, pulmonary disease is feared less, muscular relaxation is good and there is an economy of personnel, time and money. . . . The intravenous administration of anesthetic agents is not new in military surgery, as it was attempted with ether and with alcohol many years ago. Intravenous anesthesia, however, has been used on a large scale only since the introduction of barbiturates in relatively modern times and has not been given a test during a major war. . . . Intravenous administration of barbiturates seems to be adapted to war surgery because of the rapidity of the induction and the emergence from the anesthesia, simple equipment for use, ease of administration and their non-explosive qualities which allow use of cautery. . . . Moore listed some of the complications encountered during or after administration of a 5 per cent solution of pentothal sodium to men wounded in battle. These consisted of muscular twitching, persistent cough, laryngeal spasm, poor airway for patients who have had large doses on return to the ward, numbness of arm attributable to solution in extravascular tissues, restlessness of patients who have received less than 15 cc. of a 5 per cent solution and thrombosis in the vein used for injection. Some contraindications for this type of anesthesia in war surgery are poisoning by asphyxiant gases, shock, hepatic and renal damage, difficulty in venipuncture in some cases, previous operations on the upper portion of the abdomen, hyperpiesis, hypopiesis and

long operative procedures. . . . Rectal anesthesia by means of avertin with amylene hydrate would not seem feasible close to the battle lines but may be of use in hospitals, stations and base hospitals. Its use is especially indicated for patients who have been poisoned with a vesicant or suffocating gas. Colonic ether-oil anesthesia has been found satisfactory for operations about the face. . . . Cyclopropane probably will not prove to be practical in the field, owing to its explosiveness and the technical difficulty of administration. It may be useful, however, in base hospitals, where conditions approximate more closely those of civilian practice. . . . The administration of gaseous anesthetic agents by means of an intratracheal tube has proved to be exceptionally adaptable to military use, especially for intracranial, thoracic and facial operative procedures. Although ethylene and divinyl ether have been suggested as possessing properties suitable for use in war surgery, they both present the same disadvantages as cyclopropane, without the latter's potency and low toxicity. Hypnotism has been suggested as a means of anesthetizing soldiers but is not advised for major surgical procedures." 169 references.

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BOURNE, WESLEY: *Anaesthesia in War Circumstances*. *Canad. M. A. J.* 46: 241-245 (Mar.) 1942.

"While it is evident that the general principles of anaesthesia are not affected by the circumstances of war, it is equally evident that it is our duty assiduously to seek those means in anaesthesia which are especially suited to the exigencies of battle. . . . Wherein there is little or no shock, the subject of lesser lesions will have received, promptly for his pain, an opiate, with which it is well to give scopolamine to enhance its action, dispel fear and