PAIN IN MEN WOUNDED IN BATTLE

LT. COL. HENRY K. BEECHER, M.C., A.U.S.

CONSULTANT IN ANESTHESIA AND RESUSCITATION, MEDITERRANEAN THEATER OF OPERATIONS

THERE IS A COMMON BELIEF that wounds are inevitably associated with pain, and, further, that the more extensive the wound the worse the pain. Observation of freshly wounded men in the Combat Zone showed this generalization to be misleading. If one may speak of such a subjective experience as pain in exact terms, the generalization can be said to hold in only about one-quarter of severely wounded men; it fails in the remaining three-quarters. There are practical reasons for examining this problem, for a clear appreciation of its nature will lead to improved treatment of the distress of the wounded.

The widespread tendency to serious error in the employment of one of the most useful drugs in medicine, morphine, also suggested that the treatment of pain in wounded men needed to be reviewed. An opportunity to do this was made possible during the prolonged action on the Venafro and Cassino Fronts and later at the Anzio Beachhead and in France.

MATERIAL

The factual material which serves as the basis for the observations made here is largely presented in Table I. Consecutive cases were observed, insofar as this was possible. There was no selection of patients other than (a) they had one of five kinds of severe wounds chosen as representative; extensive peripheral soft-tissue injury, compound fracture of a long bone, a penetrated head, a penetrated chest, or a penetrated abdomen; (b) they were clear mentally; and (c) they were not in shock at the time of questioning. (If shock was present on arrival, as in a few cases, questioning was delayed until the shock had been relieved.) Men wounded in battle usually have multiple wounds. The categories listed refer to the chief wound.

INCIDENCE OF PAIN

Three factors are of major importance in the suffering of badly wounded men: pain; mental distress; and thirst. Therapy has been almost entirely directed to pain, and this usually limited to the administration of morphine in large dosage. In a consideration of the pain of seriously wounded men it is advisable to distinguish between those in good general condition and those in shock. Pain and mental distress are encountered in the former group; but in well-developed traumatic shock such suffering as can be detected is commonly not from wound pain or anxiety, but is chiefly from thirst. This will be discussed briefly a little later.

To get at the incidence of pain in the several groups of patients, questions asked shortly after entry in a Forward Hospital were phrased in this way: "As you lie there are you having any pain?" (Care was taken to be certain

that the patient understood the question.) If the answer was "No," that part of the questioning was dropped. If the answer was "Yes," further inquiry was made: "Is it slight pain, or moderate pain, or bad pain?" There was usually little hesitation about differentiating here. The patients who said they were having pain of any degree were asked further if the pain was great enough that they wanted something to relieve it. (It became apparent early that morphine was an unfortunate word to use in this questioning, and it was avoided, since some were alarmed by the implication that they were "bad enough" to need this agent.) The findings are recorded in Table I.

TABLE I

215 PATIENTS WITH MAJOR WOUNDS

(Standard Errors of the Mean are Shown)

Type of Wound	Compound Fractures of Long Bones	Extensive Soft-tissue Wounds	Penetrating Wounds of Thorax	Penetrating Wounds of Abdomen	Penetrating Wounds of Cerebrum
Number of pts.	50	50	50	50	15
Pt's age (yrs.)	24.8 ± 0.9	24.5 ± 1.1	24.5 ± 0.8	22.7 ± 0.6	25.1 ± 1.4
Time since wounding (hrs.)	12.5 ± 1.3	11.3 ± 1.4	9.8 ± 1.0	7.2 ± 0.7	7.9 ± 1.4
Avg. total dose of morphine (mg.)	1 pt.: none* 49 pts. avgd. 27.0 ± 1.5	11 pts.: none* 39 pts. avgd. 27.0 ± 2.7	11 pts.: none* 39 pts. avgd. 25.0 ± 1.8	5 pts.: none* 45 pts. avgd. 29.0 ± 2.2	8 pts.: none* 7 pts. avgd. 19.8 ± 4.2
Avg. latest dose of morphine (mg.) (spread as above)	22.6	19.5	21.2	25.0	19.8
Time since latest morphine (hrs.)	7.0 ± 0.8	7.2 ± 0.6	6.5 ± 0.6	4.8 ± 0.7	6.2 ± 1.5
Pain (degree). (Number of pts. in each group)	19 none 12 slight 7 moderate 12 bad	19 none 15 slight 8 moderate 8 bad	15 none 18 slight 11 moderate 6 bad	7 none 5 slight 14 moderate 24 bad	9 none 5 slight 0 moderate 1 bad
Further pain relief therapy wanted (pts.)	11 yes 39 no	9 yes 41 no	10 yes 40 no	27 yes 23 no	1 yes 14 no
Remarks on pts. with "bad pain" (morphine in mg.)	12 pts. avg. latest dose morphine 24.8, 5.7 hrs. ago; avg. total dose 33.6	7 pts. (1 no morphine*) avg. latest dose morphine 22.8, 9 hrs. ago; avg. total dose 33.0	5 pts. (1 no morphine*) avg. latest dose morphine 19.0, 6 hrs. ago; avg. total dose 23.9	21 pts. (3 no morphine*) avg. latest dose morphine 26.0, 5 hrs. ago; avg. total dose 29.4	Only 1 pt. reported bad pain; he had morphine 30.0, 14 hrs. ago (compare with avg.)
Remarks on pts. where no further pain relief therapy wanted (morphine in mg.)	Avg. total morphine in 38 pts. (1 no morphine*) 28.1; latest dose 7.4 hrs. ago (avg.)	Avg. total morphine in 30 pts. (11 no morphine*) 27.5; latest dose 6.5 hrs. ago (avg.)	Avg. total morphine in 30 pts. (10 no morphine*) 26.1; latest dose 6.4 hrs. ago (avg.)	Avg. total morphine in 21 pts. (2 no morphine*) 30.1; latest dose 5.1 hrs. ago (avg.)	8 pts. had no morphine here. Others received only 1 dose; (for size and time see above)

* Not included in the average.

Ten of 225 patients who were approached had to be discarded from this consideration because they were unconscious or not mentally clear. Nine of these had penetrating head wounds. If all penetrating head wounds are excluded, only one patient out of the other 201 seriously wounded patients was not alert and mentally clear at the time of examination, and, accordingly,

had to be eliminated from this study, an interesting point in the light of the puzzlingly low incidence of pain found.*

In Table I the data are broken down into considerable detail, for those who are interested in the composition of the material on which conclusions are based. The nature of these observations is such, however, that it will be safest to confine the attention largely to the over-all effects rather than to details of questionable significance. In line with this it is interesting to observe that:

	69 patients, or	32.1%, had no pain
	55 patients, or	25.6%, had slight pain
	40 patients, or	18.6%, had moderate pain
	51 patients, or	23.7%, had bad pain
Total	215	100.0%

Naturally, a close parallelism exists between the number wanting pain relief medication and those reporting bad pain:

Bad pain reported:	
Yes	51 cases, or 23.7%
No	164 cases, or 76.3%
Pain relief therapy wanted:	
Yes	58 cases, or 27.0%
No	157 cases, or 73.0%

This close agreement of those reporting bad pain and those wanting pain relief therapy offers supporting evidence that the pain was accurately characterized.

Of the 51 patients who reported bad pain, five had had no morphine, the remaining 46 averaged 24.5 mg. for the most recent dose (compare with the average size of the most recent dose for each of the several groups), and averaged 30.5 mg. for total dose. Of the 157 who did not want further pain relief medication 32 had had no morphine, the remaining 125 averaged 27.3 mg. for total dosage. The time since the most recent dose of morphine was administered is comparable in the two groups: those who had bad pain and those who did not want further pain relief (Table I). Likewise, comparable are the total doses of morphine in the two groups. These data indicate that the patients with bad pain are not to be explained as having received less morphine or having gotten it longer ago than those who did not want further pain relief therapy.

In round numbers, the following percentages of patients in the various groups said they had bad pain:

Penetrating cerebral wounds	7%
Penetrating wounds of the thorax	12%
Extensive soft-tissue injury	16%
Compound fractures of long bone	24%
Penetrating abdominal wounds	48%

* A badly injured patient who says he is having no wound pain will protest as vigorously as a normal individual at an inept venipuncture. It seems unlikely that the freedom from pain of these men is to be explained on the basis of any general decrease in pain sensitivity.

Evidence that morphine is too often given by *rote,* and not according to the pain present, is found in the fact that bad pain was reported four times as often in the penetrating abdominal wounds as in penetrating wounds of the thorax, yet there is no important difference in the quantity of morphine administered to the two groups.

Abdominal wounds, on the basis of actual records, are, thus, found to cause far more pain at the time of entry into the Forward Hospital than other wounds do. Probably this great pain is due at least in part to spilling of blood and intestinal contents into the peritoneal cavity. Perhaps infection also has a part in increasing the pain.

Three-quarters of badly wounded men, although they have received no morphine for a matter of hours (Table I), have so little pain that they do not want pain relief medication, even though the questions raised remind them that such is available for the asking. This is a puzzling thing and perhaps justifies a little speculation. It is to be remembered that these data were obtained entirely from wounded soldiers. A comparison with the results of civilian accidents would be of interest. While the family automobile in a crash can cause wounds that mimic many of the lesions of warfare it is not at all certain that the incidence of pain would be the same in the two groups. Pain is an experience subject to modification by many factors: wounds received during strenuous physical exercise, during the excitement of games, often go unnoticed. The same is true of wounds received during fighting, during anger. Strong emotion can block pain. That is common experience. In this connection it is important to consider the position of the soldier: His wound suddenly releases him from an exceedingly dangerous environment, one filled with fatigue, discomfort, anxiety, fear and real danger of death, and gives him a ticket to the safety of the hospital. His troubles are about over, or he thinks they are. He overcompensates and becomes euphoric, as Douglas Kelling has found. Whether this actually reduces the pain remains unproved. On the other hand, the civilian's accident marks the beginning of disaster for him. It is impossible to say whether this produces an increased awareness of his pain, increased suffering; possibly it does.

Evidence has been presented above that morphine has not been given with reasonable accuracy to those needing it: doses given do not adequately parallel the pain present; delayed morphine poisoning, and the not uncommon tendency of some months ago to overdose point the need for improvement in the use of morphine. If it is borne in mind that almost the sole justification for the use of morphine is severe pain, and inquiry made concerning the need of a given patient before administering it, the situation will be improved.

TREATMENT OF PAIN: USE OF MORPHINE

Elementary as the following points may seem to the informed, constant repetition of them was found to be necessary:

Administration.—a. Dosage. Nearly the maximum analgesic effect of morphine is produced by smaller doses than generally supposed: Morphine ¼ gr. (15 mg.). Larger doses chiefly cause undesirable side-effects. They impair the body's power to overcome adverse situations. Usually morphine is not to be administered in greater than ¼ gr. (15 mg.) single dose. Use only small doses in patients to be transported by air, ⅛ gr. (8 mg.) to ⅙ gr. (10 mg.). Respiratory depression here is particularly undesirable (allay apprehension and fear of the first ambulance plane flight with barbiturates).

b. Route. Subcutaneous or intramuscular injection is employed when a gradual, prolonged effect is sought. This route is avoided when the peripheral circulation is slowed by cold or low blood pressure (see discussion below of delayed morphine poisoning in battlefield casualties). A better choice in such cases is intravenous injection. This is the best route also when immediate pain relief is wanted, or when delayed absorption might prove harmful, as in anticipated or developing shock. When injection is impossible (no syringe) morphine ¼ gr. (15 mg.) may be held under the tongue until it is dissolved.

Indications. The only really important use for morphine is to relieve severe pain. Use aspirin or codeine for mild pain. In the absence of respiratory depression, head or chest wounds do not contraindicate the use of small doses of morphine, if these or associated wounds cause pain. The use of morphine in preanesthetic medication has been greatly overdone.

Contraindications. a. Morphine will not be used as a sedative for "the jitters" or for "nervousness," in manic or hysterical states, for allaying fear, for promoting sleep (unless pain is present). Such use cannot be defended. For these conditions better agents are available (phenobarbital or pentobarbital sodium or paraldehyde). Neither is morphine to be used for controlling the restlessness associated with hemorrhage.

b. Morphine will be avoided (except where pain is present) as a routine agent in the preanesthetic medication of seriously wounded patients. Anesthesia is usually easy to induce in them, in any case.

c. Morphine will not be administered in the field to a patient who must walk back to the Aid Post. At the Aid Post it will not be given to the wounded man who must at once be evacuated to the rear as "walking wounded." Such may become confused, lie down along the evacuation route, and go to sleep. Evidence is accumulating that nausea following morphine administration is more frequent and more severe in ambulatory patients than in patients at rest lying down.

d. Morphine is contraindicated in shock unless pain is present. (See description below of effects morphine has on the respiration, circulation and fluid balance.)

e. Morphine is widely recognized to be dangerous in conditions of low metabolism, as in hypothyroidism.

f. Morphine is largely destroyed in the liver; therefore, it should be

used with great caution, if at all, in the presence of liver disease, as infectious jaundice.

g. Morphine will be used with great caution, if at all, when even minor degrees of anoxia might be dangerous, as in circulatory impairment, or when the respiration is already impaired, as by pneumothorax, hemothorax, or pleural effusion, when mechanical obstructions of the air-way are present or when central depression exists, morphine is ordinarily contraindicated.

Poisoning. This is first characterized chiefly by slow respiration and pin-point pupils. The outstanding serious effect of overdosage with morphine is respiratory depression, with anoxia. This is followed by circulatory damage. Less severe poisoning than the above, even therapeutic doses, often complicate treatment of the patient: morphine, in causing anorexia, nausea and vomiting, limits the intake of food and fluids by mouth and increases fluid loss in vomitus and sweat. Severe constipation is produced.

Delayed Morphine Poisoning in Battle Casualties. a. When the peripheral circulation is sluggish or inactive, as it may be in patients who are chilled or who have low blood pressure, subcutaneous injections of drugs are poorly absorbed. This was frequently observed to be the case in the Italian campaign.[1] Subcutaneous injection of morphine, under circumstances where absorption fails, does not relieve the pain of wounded men. Repeated injections, sometimes over a period of many hours, are not absorbed until finally, by shock therapy and warmth, the circulation is reëstablished in the skin and subcutaneous regions. All of the unabsorbed deposits of morphine are then taken up by the active circulation so rapidly that signs of morphine poisoning previously not present then appear, as shock is overcome.

b. Although the intravenous use of morphine is desirable and would eliminate the problem, such use is not ordinarily practicable under outside field conditions. In this case, intramuscular injection followed by massage is the choice. All morphine injections should be made low enough on an extremity so that a tourniquet can be placed proximal to them if poisoning develops. Care is to be exercised in recording dose used, time given, and site of injection.

Treatment of Morphine Poisoning. Realization that morphine intoxication may have a rather abrupt onset many hours after the last morphine injection, under the circumstances discussed above, is a considerable help in recognizing the problem at hand. Correct diagnosis leads to prompt and effective treatment. A tourniquet, intermittently loosened, is placed proximal to the site of the injection. Primarily, the treatment of morphine poisoning consists in the effective prevention of anoxia. This is best accomplished by oxygen administration, with artificial respiration (if necessary) easily carried out with the aid of a closed anesthesia apparatus by means of intermittent bag pressure, with carbon dioxide absorption. Atropin 1/60 gr. (1 mg.) intravenously may be of value. Ephedrine ½ gr. (30 mg.) intravenously has some value as a central stimulant. It may help to support a falling blood pressure. Hypertonic glucose intravenously is a good diuretic and aids in

excretion of morphine by the kidneys. Body heat should be conserved. If coma develops, a gastric tube should be inserted in order to eliminate the possibility of aspiration of gastric contents. Moreover, frequent change of position is of value in reducing the later appearance of pulmonary complications. The treatment is supportive while the morphine overdose is largely destroyed in the body.

TREATMENT OF PAIN: MISCELLANEOUS MEANS

Regional Nerve Block. Various appropriate regional nerve blocks are of use. Outstanding here is the use of intercostal or paravertebral nerve block for controlling the pain of chest wall injury. This is followed by pulmonary ventilation more nearly normal in character. These blocks are so easily and quickly carried out, and afford such striking relief, it should be widely used. The usefulness of the local injection of procaine in the presence of some sprains is well-established.

Proper Splinting and Bandaging. The need for adequate wound support is so obvious as to require little comment, yet a common needless cause of severe pain is the swelling of the lower leg and foot in the case of fracture of the long bones of the extremity. The shoe should always be unlaced and slit if left on. Failure to observe this has led to many hours of acute suffering in patients who get prompt relief when this is done.

EMOTIONAL FACTORS AS WELL AS PAIN REQUIRE TREATMENT

The circumstances that have led to the wound may have been associated with anxiety; with emotional stress; with grief from the loss of friends; with fear; and these have often been exaggerated by the sights and sounds of prolonged combat, coupled with the physical discomforts of exposure to the weather, inadequate food and fluid intake, loss of sleep, exhaustion, as well as by pain. On top of all this the newly wounded man suddenly has to face the consequences of his wound: His arm is injured—will he lose it? There is blood around his genitals—will he be impotent? That wound in his chest—is he going to die? Given half a chance, indications of great mental agitation come out in a rush, from men who have been lying quietly, often seemingly asleep. Others react to this inner turmoil by restlessness and occasionally by manic states. (See the case referred to below.)

It is unlikely that lives are lost by the busy medical officers disregard of these mental and emotional factors at this early period in the patients' care; but what effect such disregard will have on the patient's later course has not yet been adequately considered. Thoughtful discussion of their cases with a few wounded men in any preoperative ward will show that much needless suffering results from neglect here. Neglect of these emotional problems at this time may have a profound effect on the patient's attitude toward his wound and to return to duty. Important from the military viewpoint is the inescapable fact that the patient's permanent outlook is powerfully and lastingly influenced by events at this time. Examples: The un-

warranted lighthearted statement by a medical officer that the patient will go home now that he is wounded, although later proven untrue, has done its damage, and it becomes in many cases impossible to reëstablish the qualities of a good combat soldier in the healed patient. A disease labelled "shell shock" is often incurable; whereas if it be called merely exhaustion, a good response to treatment is obtained, *etc.* The early hours after wounding are important for establishing a point of view in the patient that will be of help in his early return to duty. More study of this period by psychiatrists is needed.

Part of the difficulty with the treatment of the distress of the wounded is that morphine is often employed in an attempt to treat conditions that will not respond to it however large the dose.[2]* Patients are described as "writhing in pain," and large doses of morphine administered when the real problem is restlessness from cerebral anoxia, or excitement from fear and apprehension. In the former case correction of the oxygen shortage, in the latter, sedation, as with barbiturates, is indicated, not morphine.

Certainly, no one wishes to minimize the importance of adequate pain therapy (morphine): but there is too little realization that treatment of the actual pain present is only part of the job to be done. Wounded men need sedatives of the barbiturate type as well as narcotics. At times *small doses of both types of agent will accomplish what large doses of either alone will fail to do.*

Use of barbiturates in treating the agitation encountered in the wounded is illustrated by the following example:

Case Report.—A husky 19-year-old soldier was wounded at the Anzio Beachhead by a mortar shell. Five hours later he was brought into the nearest hospital with a meat cleaver-like wound cutting through the fifth to 12th ribs near the vertebral column. He had bled a great deal (hemoglobin 9.5 Gm.; not yet completely diluted) and was cyanotic. Obsessed with the idea that he was lying on his rifle, he constantly struggled to get off the litter and complained bitterly of the "pain." Three attendants were necessary to keep him on the litter. Examination of the patient in any adequate sense was impossible. He appeared to be wild from pain. His wound supported such a belief. (Not only were eight ribs cut in two, and an open pneumothorax present, but later it was found that the lower lobe of the lung, the diaphragm, and one kidney had been lacerated by a broken rib end.) He had had no morphine for at least four hours, and it was planned to give him more; but since the situation was confused, it was decided to give him 150 mg. (2.5 gr.) sodium amytal by vein. This was done, and he at once quieted down and went to sleep. Obviously no morphine was needed.

The patient was rousable but remained quiet for the next hour, until he went to the operating room. During the quiet period he was examined, and catheterized, previously impossible, and found to have grossly bloody urine. Immediately after receiving the barbiturate his color improved strikingly, doubtless in part due to the cessation of great physical exertion and to the fact that instead of constantly yanking out his nasal oxygen tube, it stayed in place, and his blood pressure rose at once from 60 up to 80 mm. Hg., systolic. Before the barbiturate was given all agreed that the patient's condition was rapidly deteriorating; he turned for the better immediately after the

* A common error in civil medicine as well as in warfare.

amytal was given. The dose given would not have controlled pain. It is reasonable to conclude that his manic state was not due to pain.

In the group of patients that received a sedative during the course of this study, sodium amytal was used intravenously, not from choice but because it was the only barbiturate available at the time for intravenous use. Had it been available nembutal sodium would have been used. Whenever sedatives are employed in the wounded, it must be remembered that depleted, bled-out individuals, men in shock, appear to be extraordinarily sensitive to these agents. It is best not to exceed at a given time a single dose of one grain (60 mg.) of sodium amytal for intravenous use in such patients. This can be repeated after 15 or 20 minutes.

THIRST

The data contained in Table I are based entirely on men who, although severely wounded, were not in shock. In these men thirst often causes considerable distress; but on the basis of records kept on 50 of these patients it is nearly always less a cause of discomfort than the wound. In the case of men in traumatic shock thirst rises to first place as a cause of suffering. Men in shock complain bitterly of thirst; they much less frequently complain of pain.

The administration of fluids by mouth is undesirable in patients who are soon to be anesthetized. Some relief is given by sponging-off the lips and by mouth rinses. Correction of the thirst requires restoration of the depleted blood volume, best achieved by intravenous fluid therapy.

Considering the amount of suffering caused by thirst in the badly wounded, it is curious that so little attention has been paid to ways of minimizing this symptom.

SUMMARY

Severe wounds in soldiers are often associated with surprisingly little pain. In order to get factual information on the incidence of pain, 225 freshly wounded soldiers were considered in five groups where the wounds were serious—compound fractures of long bones; extensive peripheral soft-tissue wounds; penetrating wounds of the thorax; penetrating wounds of the abdomen; and penetrating wounds of the cerebrum. None of these men was in shock at the time of questioning. As nearly as possible consecutive cases were considered. Ten of these had to be eliminated from consideration here because they were not clear mentally, or were unconscious. Nine of these ten had penetrating head wounds. If the head wound group is entirely disregarded, only one patient out of the remaining 201 severely wounded was not alert and clear mentally.

Of the various types of wounds considered, patients with penetrated abdomens have by far the most pain, possibly due to the spilling of blood and intestinal contents into the peritoneal cavity. Of all the patients considered only one-quarter, on being directly questioned shortly after entry in a

Forward Hospital, said that their pain was enough to cause them to want pain relief therapy; three-quarters did not need such relief. This was the case notwithstanding the fact that the most recent morphine had been administered hours before (Table I). Evidence is presented to show that the difference between the one-quarter that wanted pain relief therapy and the three-quarters that did not, cannot be explained by differences in dosage or timing of the morphine administered. Data are presented to show that morphine is too often administered by *rote* and not according to the patient's need. The data carry the strong implication that morphine is too often used in the belief that severe wounds are inevitably associated with bad pain—clearly not the case. The use of morphine in the treatment of pain is considered in detail.

It was observed that the excitement and hyperactivity occasionally encountered in the wounded had its origin in some cases not in pain but in cerebral anoxia, and more commonly in mental distress. Use of a small dose of a barbiturate provided great relief in the latter type of case. A small dose of a barbiturate in addition to a small dose of a narcotic will accomplish what large doses of either alone will often fail to do. Barbiturate sedation offers a real addition to the treatment of the wounded man. He often needs the type of mental depression produced by barbiturates in small dose as much as he needs the pain depression produced by morphine.

The man in shock complains far less frequently of wound pain than he does of the great distress produced by thirst.

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