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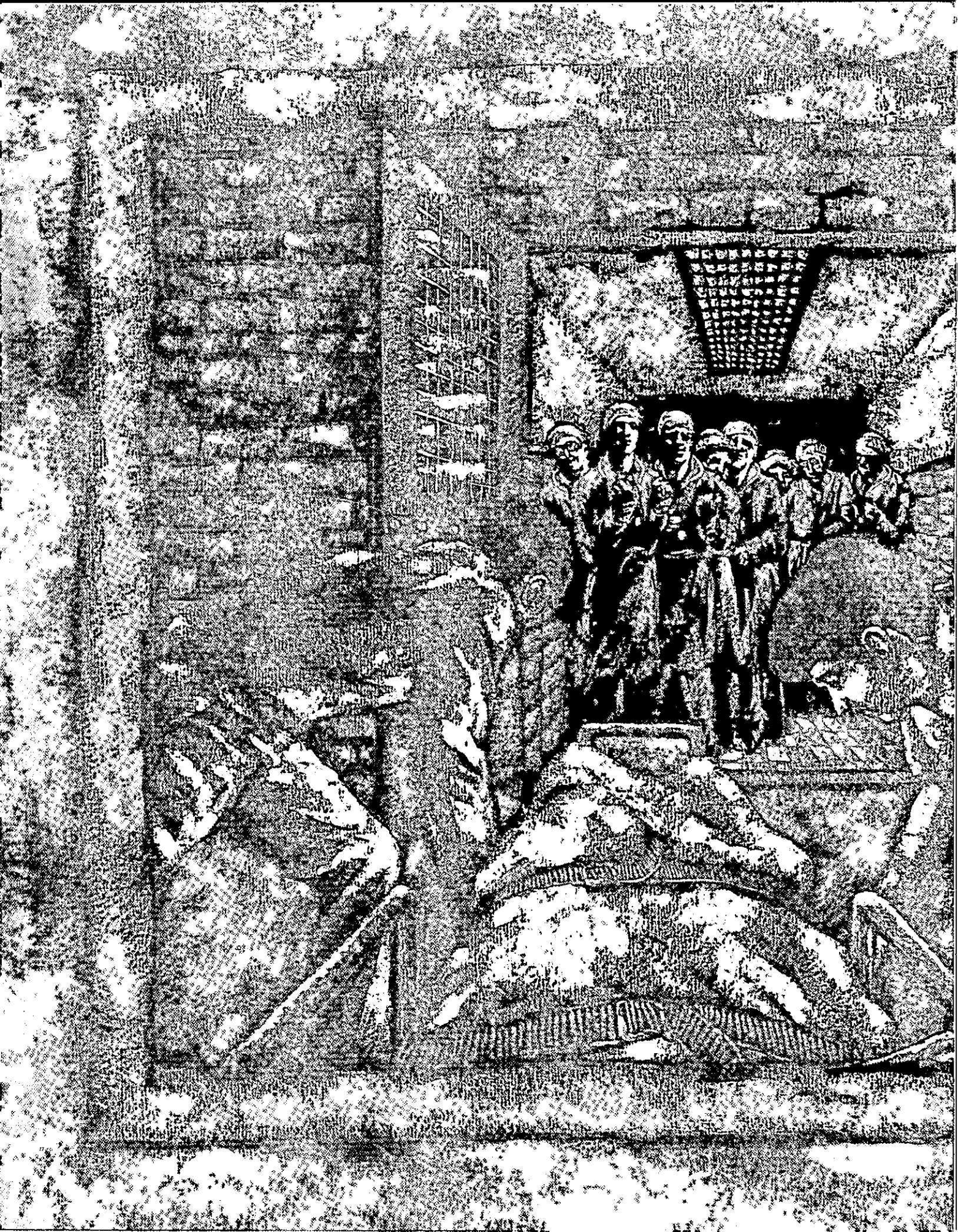
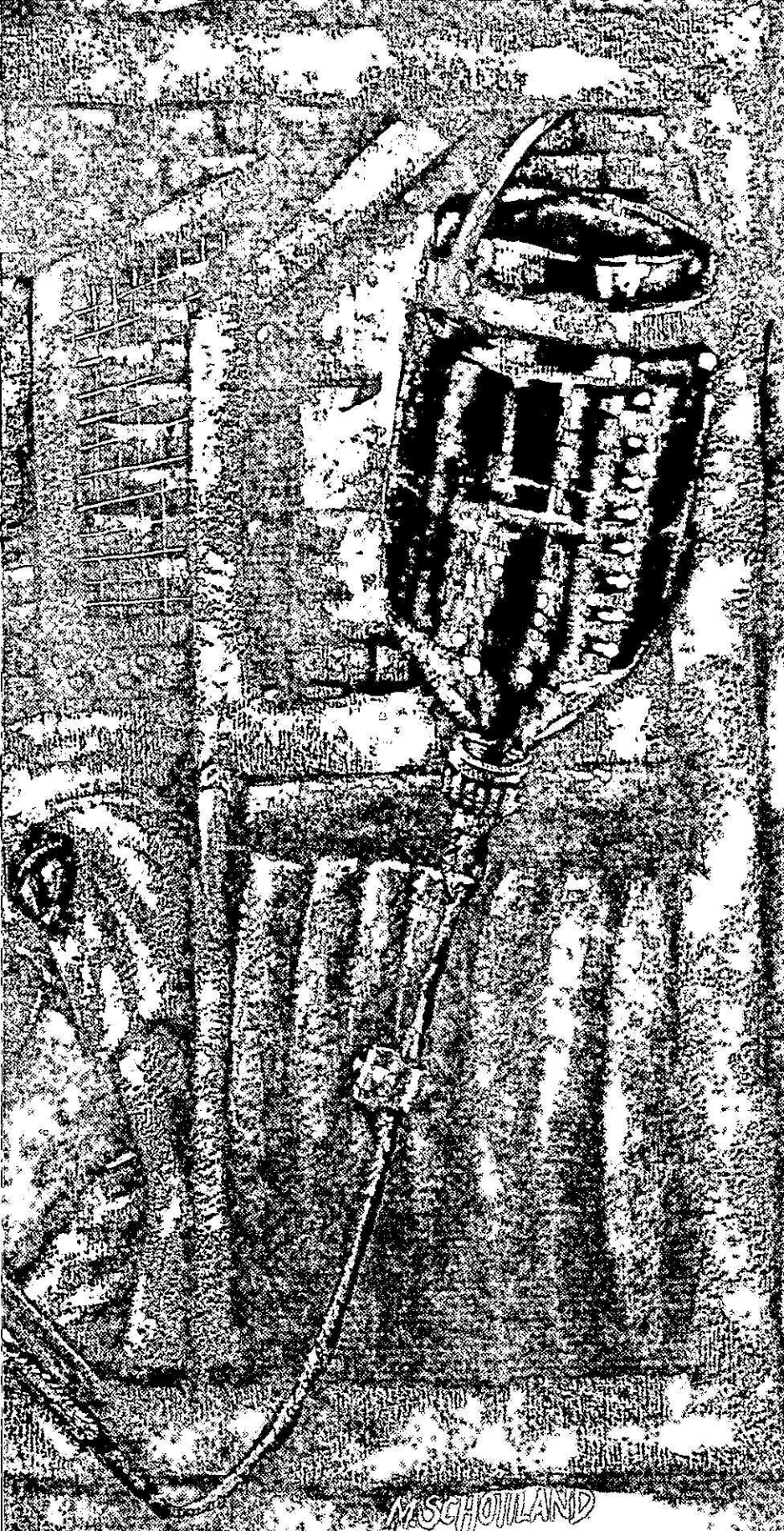




NOTES FROM A TRAUMA TEAM

Victim of a horrendous accident, he's brought in barely clinging to to life. You've no idea how many different kinds of injury he's suffered, how many vital organs are smashed and pouring out blood beneath his chalky skin. With so much to find out and deal with in so little time, where do you start? How do you give him back the life that's fast slipping away?

The Maryland Institute for Emergency Medicine, in downtown Baltimore, offers you many answers—some defying tradition—to these hauntingly familiar questions.

The institute, housed in a five-story building adjoining the University of Maryland Hospital, is specifically designed to handle critically ill and injured patients. Most have been in catastrophic auto accidents. Most are brought in unconscious—generally by helicopter, for the institute serves the entire state of Maryland as well as areas of the adjoining states and Washington, D.C. And most—about 80%—survive.

Including some pronounced "dead" at the scene.

Few hospitals will be able to duplicate the institute's approach to treatment right down the line. But the institute's /*continued*

most vital methods and principles of trauma management need no sophisticated setting anyway; they'll help you save lives with what you already know and have. You may want to adopt the center's quick way to check for internal bleeding, for example, or their technique of transfusion, or—in a different sense of saving a life—their approach to preparing an amputee emotionally for the ordeal of returning to the outside world.

Before going into this, however, a few words about *why* the institute came into being, the philosophies that guide it, and the role it plays in Maryland's system of emergency care:

Back in the 1950s, when institute director Dr. R Adams Cowley was chairman of the division of thoracic surgery at the University of Maryland Hospital, he recalled for EM, "we had seven postoperative beds for heart surgery and we had to make rounds several times a day because those were the days before sophisticated equipment and it was the only way you could try to evaluate what was going on. So you would go down the line with your doctors and nurses and sometimes by the time you'd get to the last patient, the patient in the first bed was dead. This caused us so much consternation that we started three programs—one, to develop better care by the physician; two, better care by the nurse who *is* the physician when he isn't there; and three, we began developing monitoring systems. In fact, everything we've done over the years is for one reason—necessity."

In 1956 he began animal research into shock, which he refers to as "a momentary pause in the act of death." Four years later the Army awarded him a grant that enabled him to open a four-bed unit in the hospital to study shock and trauma problems. And in 1969 the present building opened with a capacity of 32 beds. To supplement local ambulance facilities, the Maryland state police Medevac helicopter program was established to provide emergency evacuation from anywhere within the state. The institute trains at least one member of each two-trooper crew as a cardiac rescue technician, the next level of proficiency above emergency medical technician. Although the crews spend most of their time on regular police work, controlling traffic from the sky, chasing fleeing cars, they immediately swoop off when an alert comes through to go to the scene of an accident. Each helicopter can carry two litter patients.

Finally, in 1973, Maryland's governor created a Division of Emergency Medical Services, headed by Dr. Cowley. Briefly, the program divides the state into five regions, each with various categories of emergency facility that are linked by a network of communication and transportation systems and are backed up by five "specialty referral centers." These, in addition to the institute, are the pediatric trauma unit at Johns Hopkins, the burn treatment center at Baltimore City Hospitals, the neonatal intensive care units at Baltimore City and University of Maryland hospitals and the new hand treatment center at Baltimore's Union Memorial Hospital.

Most people in Maryland are within an hour's helicopter flight of these specialty centers—a vital factor, says Dr. Cowley. "There's a golden hour between life and death," he explains. "If you are critically ill or critically injured you have less than 60 minutes to survive. That doesn't mean you'll be dead in 60 minutes but if you're not in the right place at the right time, seen by the right people, your chances of dying are greatly enhanced. You might not die right then; it may be three days later or two weeks later—but something has happened in your body that is irreparable."

The institute has four teams of general surgeons, anesthesiologists, and nurses to handle admissions; one team is always on duty. At the institute, says director Cowley, getting an emergency patient isn't like "getting a surprise package where you open up the back door of the ambulance, wondering what you've got. A dead man? Somebody whose guts are spilled all over the floor? Somebody whose leg is off? And then you have to start massing the troops, looking for this kind of guy, that kind of guy." Rather, the ambulance or helicopter crew alerts them in advance about the type of case to expect.

An anesthesiologist and a nurse meet at the helipad atop University Hospital's parking garage, while the rest of the team waits, scrubbed and gowned, in the admitting area. Every piece of equipment they will need has its special place so that everyone knows exactly where to reach for what. Portable x-ray equipment stands ready. "Critically traumatized patients shouldn't be moved," explains Dr. Cowley. "Many animal experiments have demonstrated that you bleed an animal to a certain blood volume and then all you had to do was move his leg and it would kill him." Sometimes surgery is performed right in the admitting area, even though there are two adjoining operating rooms. Downstairs are two hyperbaric chambers; upstairs, a 24-hour clinical lab. By printouts and phone, the team will quickly get reports on blood gases, electrolytes, urine, and so forth.

Once the helicopter crew has reached a decision at the scene that this is a case for the institute, they're instructed not to waste time on anything but the most imperative life-preserving procedures. A must, of course, is to stop external hemorrhaging. And when a patient is unconscious, the technician inserts an esophageal obturator. Basically, it's an esophageal tube with air holes at the level of the pharynx and an inflatable cuff that seals off the esophagus. You ventilate the patient either by blowing through the tube or by attaching an Ambu bag to it.

It's the job of the anesthesiologist-nurse welcoming team to get the patient from helipad to institute without mishap. The physician sees to the all-important airway. If cardiopulmonary resuscitation is necessary, they start —or continue—it on the short ambulance trip to the admitting area.

And the patient's clothes are removed, usually cut off, in transit. Once he arrives in the admitting area, what one team member calls controlled chaos erupts. Although one group may be working on the victim's head and another on his abdomen, the team —with the surgeon serving as leader —pretty much follows a protocol. And the all-important first steps are resuscitation and stabilization—*without* waiting for x-rays or tests or any attempt at diagnosis.

Initial anesthesia

Any patient who's in shock, head-injured, or in, or potentially headed for, respiratory distress is intubated and put on a mechanical ventilator with PEEP. And at the same time "we do something that perhaps is a little unusual," says anesthesiologist T. Crawford McAslan, professor and head of the division of critical care medicine. "We actually lightly anesthetize all patients, conscious and unconscious, and give them a muscle relaxant. We feel this is a humanitarian function in that we relieve pain for the patient, in addition to optimizing oxygen delivery and minimizing metabolic demands. He doesn't feel the discomfort of having his arms and legs moved while we take x-rays and do tests. It also makes things go faster because the surgeons can put in lines without the patient struggling. Furthermore, while the patient is still in the admission area, the surgeon can take a knife at any moment and make an incision, put his hand inside, and control any intra-abdominal bleeding by direct pressure on the main vessels. It's all systems 'go' from the time the victim comes in. We can act in seconds if he doesn't respond or deteriorates suddenly." They use 50% nitrous oxide to anesthetize the patient and, as a muscle relaxant, succinylcholine for the head-injured—since it can be reversed quickly for neurologic evaluation—or, for most other patients, a longer-acting drug like curare.

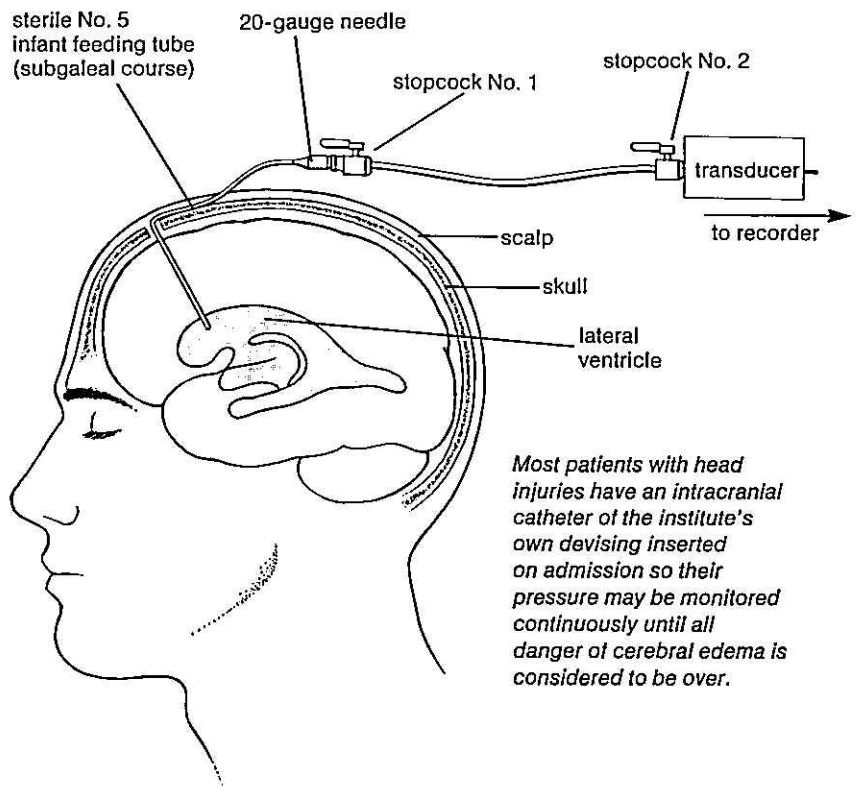
During this time the surgeon has already made a very fast assessment of the patient: Is he awake, can he be awakened by stimulation, or is he unconscious? Are his pupils equal, can he move his limbs, or is he paralyzed? Then the surgeon draws venous and arterial blood samples for quick dispatch to the lab and, while other team members are fastening EKG leads and catheterizing the patient's bladder, he inserts a CVP catheter, through the subclavian vein if possible, and four IV lines—the largest ones possible, by cutdown if they won't go in almost instantly—two above the diaphragm and two below.

"We've learned that sometimes a patient may have ruptured vessels between the neck and heart and if you put all your lines in from the top you may just be pouring the blood into the chest. Similarly if you put them all below, the pelvis may be injured and you're pouring all the blood into the pelvis. But if we have lines above and below, as soon as we identify a pelvic injury we go easy on the lower ones; if we find serious chest injury, we go easy on the chest line. Or if you identify a lower injury you go easy there."

Plasma first

For fluid replacement, the institute team starts off with plasma or plasma protein fraction, their own preference. "We don't start with blood immediately," says attending staff anesthesiologist Baekhyo Shin, "because we may be able to resuscitate the patient with just the colloid part. We'll be prepared to run in up to a liter." Then if the patient still isn't stabilized they add packed cells. A unit each of the synthetic plasma and packed cells makes a unit of blood so "we recon-

Be prepared



Most patients with head injuries have an intracranial catheter of the institute's own devising inserted on admission so their pressure may be monitored continuously until all danger of cerebral edema is considered to be over.

stitute the blood," he adds. If a patient absolutely has to have whole blood, he'll get group O positive; a supply of 7 units is kept in the admitting area. Cross matching is done on every patient, of course, but even under these best of circumstances, that takes about an hour—and "our patients are either alive or dead in an hour."

The use of O positive isn't ideal, to be sure, adds Dr. Ernest A. Austin, chief of surgery and traumatology. "O negative would be ideal but you just can't keep a supply of rare O negative blood on hand in the admitting area as we can the O positive."

"Of course you get a reaction in some people," says Dr. Shin, "but we take that calculated risk because obviously it's better to deal with a reaction than to have a dead man."

Finally, he continues, since the replacement blood is deficient in clotting factors, patients get several units of clotting factors, in the form of fresh frozen plasma, for every 10 units of blood. "We know they're going to get deficient every time we do what's called a replacement transfusion. In fact, these people will have had all their clotting factors washed out. Similarly we know that after we've done two such washouts, we'll have diluted the number of platelets; so we give platelets every 20 units."

Another simple but vital fact, accentuated by so much massive transfusing, is the cooling effect of replacement solutions, notes Dr. McAslan. "People still don't recognize that every time you give a unit of blood you drop the temperature of the body 1° C. In our early days here we found that many patients would get down to temperatures of 31, 32° C., at which point the heart becomes very irritable and many of the cardiac arrests we had then were the result of hypothermia. Since then, all the solutions we use go through warmers."

The anesthesiologist has been paying close attention to the movement of the patient's chest as he secures the airway and the IV's are being started. He may have noticed that air isn't entering one side of the chest as well as the other. Now he listens and percusses both sides: decreased breath sounds and hyperresonance on percussion signal pneumothorax; blood in the pleural space will also cause decreased breath sounds but dullness on percussion. A chest tube is inserted at the least suspicion. "We can't wait for an x-ray," says surgeon Austin, though the traditional first step is to take an x-ray and *then* decide what to do next.

As a rule of thumb, how much bleeding from the chest tube before they go in to see what's going on? First, says Dr. Austin, you must be aware that you can't base that decision on the *initial* amount of blood loss; the patient may have bled a great deal into the chest and then stopped. The decision should be based on how much continuous bleeding there is. "If, for example, it's not obviously massive," says the surgeon, "and he loses, say, 200 cc. through the chest tube the first hour and 150 the second, we'll continue to observe him; in all likelihood it will keep decreasing every hour. Even if it's 200 the first hour and 300 the next, you might consider watching him another hour if you've got him stabilized. But unless there's a significant decrease by the third hour, you should go in." If, on the other hand, "we simply can't stabilize the patient with transfusions, if we can't catch up or we're losing ground, then we go ahead into the chest."

Mini-laparotomy for all . . .

As for occult abdominal bleeding, "we do a minor operation on almost every patient who comes in," says Dr. McAslan. Why? A recent study in Baltimore of 100 autopsies revealed 15 cases of fatal abdominal lesions that could have been corrected surgically but had never been diagnosed. Indeed, stresses surgeon Austin, you simply can't depend on a physical exam to evaluate the abdomen of an unconscious patient or a patient with serious head or chest trauma or paraplegia. And the abdominal tap, with either needle or catheter, is too unreliable, he adds; it's done percutaneously so the slightest bleeding from the abdominal wall can cause a false-positive result, and "all physicians agree that if it's negative it doesn't prove that there's no intra-abdominal bleeding."

So the institute patients get what the team calls a mini-laparotomy—a 1- to 2-inch incision is made just below the navel and all bleeding is stopped immediately. After making sure that the area is dry, the surgeon picks up the peritoneum with a forceps, puts a purse-string suture in it, incises it, inserts a length of dialysis tubing into the pelvis, and ties the purse string tight so that no blood from the wound can slip in to give a false positive. "Then we instill a liter of normal saline into the tube and siphon it off," says Dr. McAslan. "Any trace of pink signals a full laparotomy in the OR."

True, he admits, they've performed laparotomies on some patients who didn't need it—but "we have not missed a single operation that we *had* to do. Our philosophy involves a kind of trade-off—we operate on some who may not need it to be sure to save the ones who do."

Perhaps the most common injury found during laparotomy is a ruptured spleen. Indeed, since the mini-laparotomy has been so successful in detecting splenic bleeding they no longer do an arteriogram for the spleen. "We've never had a patient with a negative mini-lap who was later found to have a significant injury to the spleen," reports Dr. Robert J. Ayella, chief of radiology at the institute and associate professor and chief of the special procedures division in radiology at the University of Maryland Hospital.

Nor do they use arteriography anymore as the initial step in assessing liver damage, perhaps the second most common injury. Arteriographic evidence of interrupted blood supply used to mean dead liver, which, in turn, means resection. But Dr. Ayella has found that the liver can stay alive

and develop collateral circulation even with more than half its main blood supply cut off. So now initial evaluation is done with portohepatography, which is simpler and safer than arteriography and can be done right in the trauma unit using the portable apparatus (see EM, February 1975, p. 171). Portograms can delineate gross avascular liver damage—to be investigated with selective arteriography later on—or tell whether there's active bleeding, which must be dealt with surgically at once.

. . . plus neck and chest films

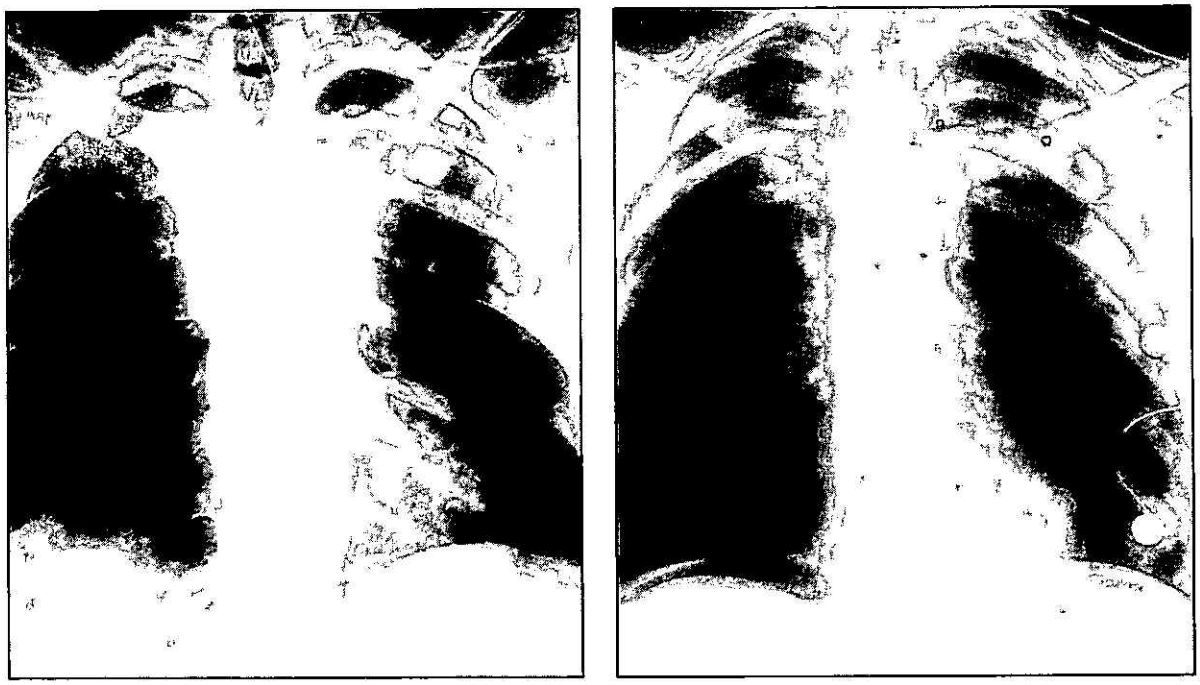
Meanwhile, back at the patient's head, Dr. Ayella or one of his radiologist colleagues is taking cervical spine films, routine procedure in *all* patients —"assuming," says Dr. Austin, "they're stable enough that we don't have to open the belly or chest immediately. This film is given a lot of lip service in medical circles," adds the surgeon, "but is rarely done unless there's some clinical indication for it —and that's usually paralysis. But most of these patients come in with no evidence of spinal cord injury. It's surprising how many of these patients do in fact have fractured necks without obvious neurological damage at that time."

Visualization of all seven vertebrae is, of course, a must, so the patient's shoulders are pulled down or he wears a cervical collar and any film that doesn't reveal C7 is repeated. If the cervical spine is normal, the patient is lifted into a sitting position for an AP chest x-ray. He is tilted slightly forward, as though he were standing for a standard PA chest film. He's being checked for a possible ruptured thoracic aorta, a prime suspect in all cases of shock-trauma, which can best be detected on an erect chest film as a widened mediastinum. Supine films aren't nearly as useful for this purpose since the mediastinum is normally widened in that position.

In a patient with cervical spine injury, you'll have to settle for a supine film, however. Just be sure that this film is read *very* carefully, warns Dr. Ayella, and that every structure in the chest can be identified. Of course, you can avoid the extra films altogether if the trauma couldn't possibly have involved the aorta, a diving accident, for example.

If the chest x-ray is at all suspicious, an aortogram is done, fast, to check out whether "the widening is due to rupture of the aorta, which requires immediate surgery, or just some bleeding from small vessels that's going to stop on its own," explains Dr. Ayella.

False alarm



This supine chest film (left) arrived with a patient sent from another hospital in shock with a diagnosis of possible ruptured aorta. But mini-laparotomy showed gross abdominal bleeding whose source, on emergency laparotomy, proved to be a severely lacerated spleen. After splenectomy, a postoperative chest film (right), taken in the true erect position, was normal. The air seen under the patient's diaphragm is the result of the surgery.

And here's where long experience and the emergency team approach really pay off. "One of the problems we're working on," says the radiologist, "is the fact that there's no aortography equipment made that will work satisfactorily in a multiple trauma unit." So the patient has to be moved to the x-ray suite in the main hospital. But "I can get through an aortogram in ten minutes, whereas it will take an hour, an hour and a half, up to four hours, at the average place. I now do this with all my arteriogram patients, just take them as if they're going through the emergency unit so I stay in trim."

Before the group started using the tilt technique, "we had a lot of false widened mediastinums," he continues. "But in the three years we've been doing it, we haven't had a patient go through an aortogram who didn't have a hematoma." Furthermore, adds surgeon Austin, "we've salvaged about 80% of patients with such ruptures."

A few words from Dr. Ayella about a so-called ruptured aorta. Most ruptures involve only the two inner layers of the vessel. "You have what looks like tissue paper or Kleenex—the outer layer—still managing to hold in the blood. However, in eight of our last ten cases the aorta was completely torn across. Every one of those patients was saved; what happens is that the pleura, adventitia, and other tissues hold the blood in temporarily. But it's a big job to move these patients from the admitting area to x-ray so I won't do a ruptured aorta unless I have an anesthesiologist there plus a surgeon standing by; if the patient's really bad we have two or three surgeons. And we bring over an entire kit for opening the chest right on the spot if we have to because we don't know at what instant one of those aortas is going to let loose. And then you've only got about four to five minutes, tops, to save them."

And they can do it. What with the patient's airway patent, the ventilator doing his breathing for him, replacement fluid running in, all monitors go, and with the light anesthesia and muscle relaxant, "we can move into an operation at the drop of a hat," says Dr. Austin. "We can literally hold on to the aorta while he's being transferred into the operating room."

The other films taken routinely right in the trauma unit are of the pelvis and skull. The limbs are x-rayed only when there's clinical evidence of a fracture. And here Dr. Ayella draws a picture of the "controlled chaos" at admission. "You have people moving in all different directions but each one is doing a specific job; the patient is having three and four procedures done on him at once. The main thing is to get him out of shock, of course, get in all the lines. Then we swing in our x-ray equipment." Plus the chest examination and the mini-lap, of course. And for the head-injured patient, two more diagnostic imperatives: cerebral pressure measurements and carotid angiograms.

A monitor for cerebral edema

Dr. Dermot P. Byrnes, attending neurosurgeon, describes this innovative addition to routine monitoring: "Let's say somebody comes in after an automobile accident. You know he's got a head injury; he's got a fractured skull—you can see it on the x-ray. Or he's unconscious or you can't get any information from him. Or he's got a headache or he's disoriented. Now traditionally you watch that patient to see if he's going to develop signs of the head injury. And at the same time you may be trying to treat him prophylactically just in case.

"We routinely put a catheter into the ventricle of the brain to measure the intracranial pressure on any patient not showing signs of cerebral improvement. If the pressure goes up we can see it immediately and treat very specifically to decrease that pressure —by surgery or conservative means." The catheter is inserted—under local anesthesia if necessary—through a small, usually right, frontal scalp incision and a twist-drill bone opening into the right lateral ventricle.

As for carotid arteriograms, "people have been doing them since 1927," notes Dr. Ayella, "usually with sophisticated equipment and rapid film changes and all, but we do them with portable equipment." Meglumine iothalamate (*Conray*, Mallinckrodt) is injected into the carotid with the film behind the supine patient's head; then a film is put beside his head, a second injection is given, and a lateral film is taken. "What we're looking for is a blood clot or a tear in the vessels," he adds, "and they can be detected with this single-shot arteriography."

The institute's radiology section can be said to have, in fact, a regular floating arteriography service. If, for example, "we have a patient who has a fractured pelvis with evidence of internal bleeding," says the radiologist, "I'll just do a portable arteriogram right there, using the same technique but without a catheter. I put a needle into one of the femoral arteries and then shoot in about 30 cc. of contrast material by hand and time the film, taking one film and then possibly a second one, three or four seconds later. Or if a patient has a loss of pulse in an extremity, I'll do the same procedure to see if any of the arteries are torn."

Then there's the patient who's had to be hurried off to the OR for surgical management of obvious thoracic or abdominal bleeding. The portable x-ray there is put right to work for any necessary pinpointing or to check for other possible injuries. And, adds Dr. Ayella, "if we should happen to be doing an aortogram for a ruptured aorta on a patient with suspected head injury, I'll flip the catheter up into the carotid and I can do that exam at the same time."

There may well be a big plus for you in this aspect of the institute's experience. For, says Dr. Ayella, "the only piece of equipment we use in the trauma unit is a portable x-ray machine, which every hospital will have. So there's no reason that any of the things—except the aortograms and the specialized things we do in the x-ray

department—can't be done by any hospital right in the emergency room."

One-stop surgery

Needless to say, emergency surgery is almost SOP for institute patients. And here, too, tradition gives way to a new approach, the result of long experience with the severely and multiply injured.

"We attempt to do all the surgery that's necessary right after admission," says surgeon Cowley. "If the patient has an intracranial lesion that needs surgery and is also bleeding in the abdomen, then two teams of surgeons will be operating. The neurosurgeons will operate on the head while general surgeons are on the belly. When all that is completed, any fractures that need to be treated are taken care of. In short, as long as the patient's condition is stable, we'll continue all therapy or as much of it as possible."

The advantages of this one-fell-swoop approach? "For one thing the patient is anesthetized only once. You don't have to keep taking him back to the operating room. Then there are certain fractures that can't be simply splinted; if they're not treated by open reduction and internal fixation right away, they require traction. And most patients with multiple injuries, with chest problems, head injury, etc., can't be treated satisfactorily in traction. As a result we're more aggressive as far as open reduction and internal fixation are concerned, even if the fractures aren't ideal for such treatment."

"We fix the head, the chest, the abdomen, the bones, one after another in order of priority," continues Dr. McAslan. "The only reason we would cut the operation short is if we needed the operating room for somebody whose life was in danger. We even do plastic surgery as an emergency procedure to minimize the need for staged procedures later on."

Adds Dr. Cowley: "When you operate on the multiply injured, you're adding severe insult to injury; it's like making them get out of bed and run a hundred yards. If you can help it, you're not going to give him another 100-yard run down the corridor tomorrow and then two days later give him still another run while he's still trying to get over the first 100 yards. After multiple surgery, the multiply injured patient is, as far as possible, physically stabilized, and the body repair process starts immediately."

What, you may ask, about the patient with underlying serious illness who winds up in the institute—the diabetic, the heart patient? "For him," says Dr. Austin, "we treat the total system and do only the surgery necessary to save his life. Most of our patients, however, are young and healthy; the bulk of them are between 15 and 35 years old."

From the admitting area, patients are taken upstairs to a 12-bed critical care recovery unit where they're monitored continuously. And they're kept on a ventilator for at least 24 hours. "We know the oxygenation is perfect," says Dr. McAslan, "and so we can relax. After a day or so we evaluate him. Does he get treated like a more ordinary surgical patient? Or do we keep him a bit longer because he shows signs of incipient respiratory or renal or liver problems or because he's still losing blood and isn't absolutely stable? Until every organ in his body looks as though it's stable, we give him all the support we can. We don't let go until we're satisfied that the body has come to grips with the injuries totally."

Pulmonary physiotherapy

Most patients get a chest x-ray every day because "the leading cause of death in trauma units, after you've gotten them past the original repair work and shock, is respiratory failure," says Dr. Ayella. "So what we try to do is actually localize the exact segment of the lung that has mucus in it. Then we hold a conference every morning with the pulmonary physiotherapists so they can clean out those segments." Only rarely have they had to resort to bronchoscopy.

No, it's not impossible to pinpoint the involved segments, even on the supine AP films commonly taken in these patients. "We prove the accuracy of our chest x-rays—as well as the value of pulmonary physiotherapy—every once in a while by taking films before and 20 minutes after a treatment. What looks like a massive pneumonia—the result of a mucus plug—in the pretreatment film will be completely resolved afterward."

Pulmonary physiotherapists aren't available everywhere, of course. What then? Nurses can do physiotherapy, says Dr. Ayella. "They won't compare with people who've been particularly trained in it but I wouldn't go back to using the bronchoscope. If I didn't have physiotherapists I would get whoever is caring for the patient to do it—nurses or the doctors themselves. The straight Jackson bronchoscope, the only instrument that will actually get the mucus out, is simply too traumatic. And the fiberoptic bronchoscope, though easier to pass, is not only still traumatic but it won't, in most cases, get the mucus out."

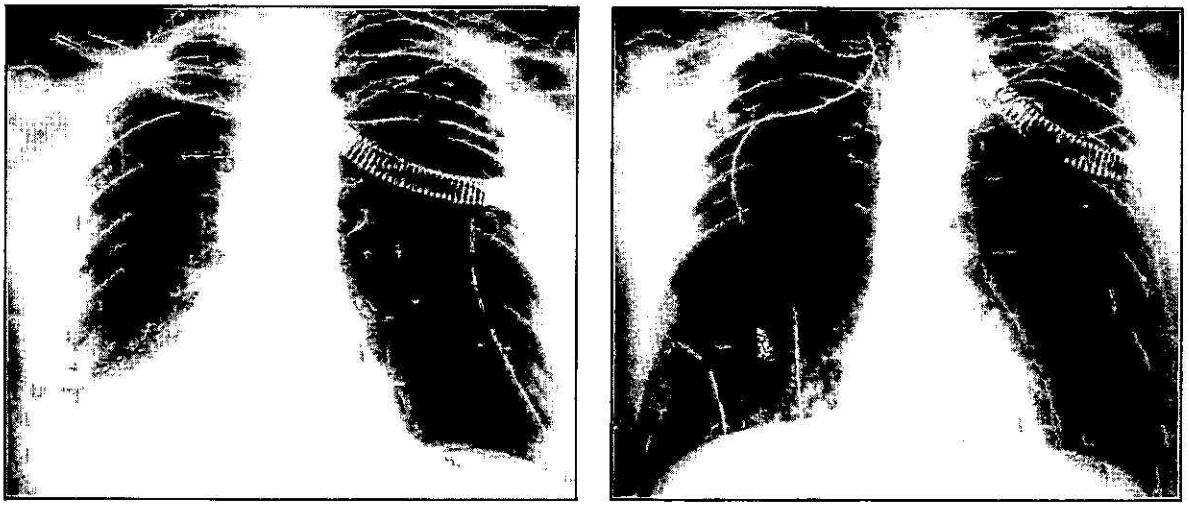
Finally, says Dr. Ayella, "we don't get shock lung," a record he attributes to the early use of PEEP to keep patients' alveoli from collapsing and the daily clearing of their lungs.

Seeing to the psyche

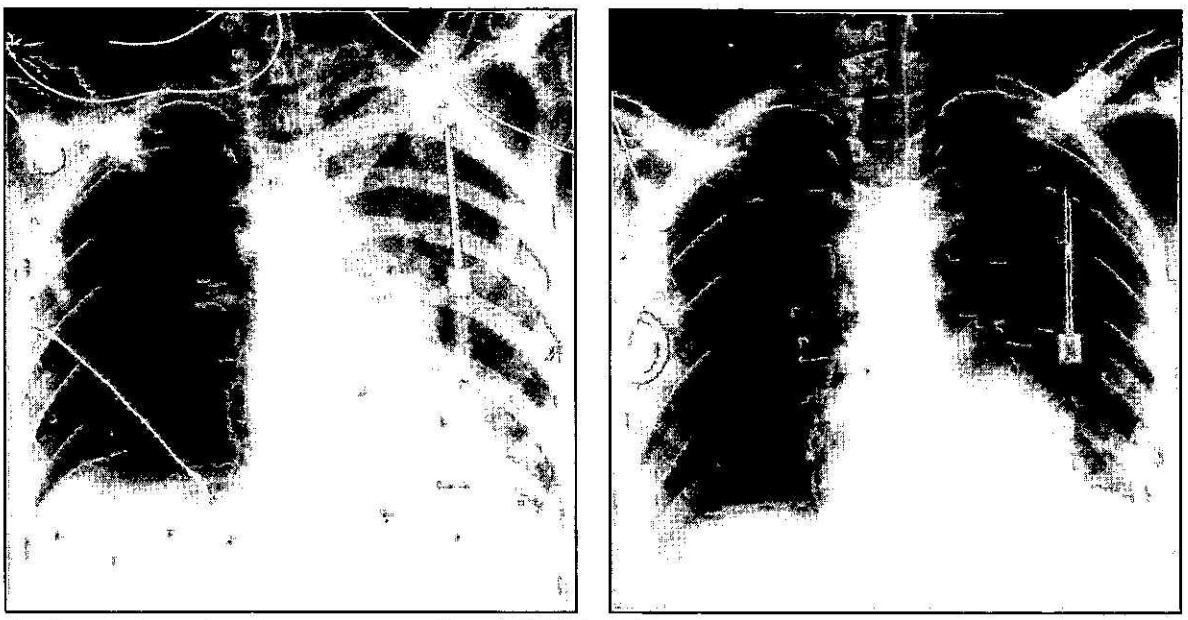
In taking to heart that familiar old admonition to treat the whole patient —easier, and considerably more often, said than done—the institute hasn't overlooked the psychological trauma of severe multiple injury. And the time to begin treatment, says Dr. Nathan Schnaper, who is chief of psychiatry at the institute and professor of psychiatry at the University of Maryland, is when the patient is unconscious.

Most patients who are brought in unconscious remain so for three days to two weeks. But Dr. Schnaper's studies of the unconscious trauma patient reveal that many of them later report having had "bad dreams"—a common theme being they're imprisoned for some wrongdoing or are dead —and that they'd also heard fragments of the conversations at their bedsides

The physiotherapeutic approach



Atelectasis of the right lower lobe is obvious on a pretreatment x-ray (left)—the heart shadow is visible but the diaphragm is obscured and the hilum pulled downward. Within 20 minutes after pulmonary physiotherapy, however, the atelectasis has cleared completely (right) with only very minimal infiltration of the area remaining.



Another x-ray reveals even more severe atelectasis (left), involving the entire left upper lobe with mediastinal shift to the left and heart and mediastinal borders obscured. But 20 minutes later it too has cleared (right).

(see EM, January 1976, p. 132). So institute personnel are instructed not only to avoid saying anything foreboding when working near such patients but to treat them as though they were conscious. Whenever possible both doctors and nurses comfort them by touching them, call them by name, explain every procedure they're going to do.

"Even though it's a one-way conversation, they'll say such things as 'Now you're going to feel a little needle. It's going to make you feel more comfortable in a few minutes. Now it's done.' "

Furthermore, when the patient regains consciousness, it's usually to total confusion. Unlike the elective surgery patient, he's not prepared for the tubes and oxygen and all the rest. At the time of his accident he had only a split second—if *that*—to be aware of what was happening. Now he not only doesn't know where he is but may be hallucinating, still in the terrifying grip of his "dreams."

He is, therefore, reoriented as quickly as possible—"Your name is so-and-so, mine is so-and-so, it's January 5, 1976, you're in such-and-such hospital," repeating it over and over. They say nothing to feed his fantasies or to imply that the staff may be making light of them—for instance, "How many 'ghosts' are holding you prisoner?"—but keep trying to bring him back to reality in a calm, reassuring way. And if he's hostile when he comes to, obviously it shouldn't be taken personally, says Dr. Schnaper, but this can be hard to do unless you're skilled at dealing with your own feelings. "Your inner self may be saying, 'Here I'm trying to help this bastard and look how the hell he's treating me,' " says Dr. Schnaper. "We see this with doctors taking care of dying patients, too. Here the doctor did the surgery on him, now the patient's got the *chutzpah* to die; it threatens his omnipotence."

Drawing on the institute's experience, Dr. Schnaper goes on to describe what you can do, in any hospital, anywhere, to help patients handle what may be the greatest emotional as well as physical blow of their lives.

You're the doctor

If the patient seems psychotic, don't be too quick to dismiss it as an intensive care unit psychosis. Check his psychiatric history: this may be a problem of long standing. Also rule out possible organic factors such as hypoglycemia or a still-uncovered neurologic injury. Expect to see a great deal of anxiety and depression, comments Dr. Schnaper; after all, they're entitled to it. Some may need antidepressants or tranquilizers but unless you're familiar with psychotropic drugs and their interactions—for these patients are usually on several medications—call in a psychiatrist. Most of these patients don't need psychotropics or a psychiatrist, however; they do need to feel free to talk out their problems with you and the nurses. For example, many of them think that their dreams and hallucinations are evidence that they're "crazy." They need reassurance that this is perfectly normal.

Be aware, too, that dealing with the severely injured and dying can put you and the nurses under a tremendous emotional strain. Sometimes it's more than you might realize, sometimes more than you think you can handle. Dr. Schnaper cites the case of a child who was apparently dead when brought in by helicopter.

"I was standing by watching the team work on him when Dr. Cowley walked in. He said to me, looking at the table, 'How long have they been working on this child?' I looked up at the clock and said, 'About an hour and a half.' Then he leaned over the table and said, 'Is this child salvageable?' "

Almost always, a fully trained, full-time surgeon on the staff serves as team leader; this time it happened to be a third-year surgical resident.

"Everyone backed away from the table but him. He didn't even hear Dr. Cowley; he was still working on the child. After a couple of minutes Dr. Cowley put a hand on his shoulder and said, 'Is this child salvageable?' The resident looked around the table and saw that everybody had moved away, so he backed away and the nurses started to wrap the child in sheets. It's the team leader's responsibility to tell the relatives, so he went out. Everybody was standing around; nobody talked; everyone was alone with his thoughts."

About ten minutes later the resident came back, tears running down his face. "He told me he couldn't be a surgeon, that he was going into his family's business. But then another call came through and they were able to resuscitate and stabilize this patient. The atmosphere became completely different. Everyone was kidding around, laughing and so on. It was great therapy. It always is."

Later, though, the resident came to see him, still upset. "He told me that at the hospital he'd come from everybody got emotional when somebody died. Here, he said, he never saw this emotionality. Furthermore, it turned out that he had a son about the same age as the boy. I reassured him that his tears were appropriate, that maybe he didn't see other people crying on the outside but all of us were crying on the inside for this little boy. He said he still wanted to be a surgeon but that he had to get used to the idea of being less emotional. I pointed out to him that this was a contradiction—that he was talking about wanting more emotionality and less emotionality at the same time. Basically, what I said to him was to be yourself, that though you lose a little bit of yourself when someone dies, your satisfaction would come from saving so many more lives than you lost."

Keep in mind, too, that you may come across tragedies that, instead of stirring your pity for the patient, may turn you molten with anger. For example, about one-fifth of the patients seen at the institute were drunk at the time of the accident. How would you react to the drunken patient who has cost the lives of innocent people, to the junkie who slipped into a narcotic

haze and slammed head-on into another car, to the auto thief responsible for a fatal accident? Unless you're alert to your feelings, your anger can cost you good medical judgment or show itself in many subtle ways, says Dr. Schnaper. Instead of "explaining that you're going to anesthetize a cut, for example, you just go ahead and stick a needle into it. And you're not even conscious of what you've done."

A family affair

As in every tragedy, there are other victims besides the patient—his family. Not only can you be of great support during the acute phase of their anguish, but you can help lay the foundation that will enable the family to cope emotionally with a paraplegic daughter or a husband without legs. Indeed, unless they have some immediate help with their reactions to the accident and the patient, their future and his may be considerably bleaker.

The institute's family service division, directed by social worker Margaret Epperson, was set up to provide this help, which begins the very moment the family rushes into the institute after being notified of the accident. And a study Ms. Epperson has made of 230 families she's worked with offers you some fundamental guidelines to therapy. There's an "identifiable process" she says, "that these families go through to reestablish the equilibrium disrupted by the sudden crisis." It usually consists of six phases but members of the same family may go through them at different times and even react to them in different ways.

The first phase, obviously enough, is that period of almost unbearable anxiety when families are waiting for word from the admitting area. Although you're not yet able to tell them how the patient is, simply letting them know *where* he is and that he's receiving expert care can be of great help. Also try to get them to talk about how they felt when they were notified of the accident; these families have a tremendous need to ventilate these feelings. Usually all you have to do to start them off is to ask something like, "Can you tell me what happened when you got the phone call?"

Then once they get word from the admitting area, they usually go through the following phases over varying periods of time:

• *Denial.* If the patient has died or is in critical condition, the most common types of reactions you get are, "How do you know the state police identified him correctly?" or "Johnny can't be paralyzed, I was talking to him an hour ago!" Don't try to *argue* them out of it but at the same time don't go along with the denial or say anything that might conceivably buttress it. Rather, as gently as possible, tune into their thinking: "I know it must be very difficult for you to realize Johnny is so badly hurt because you *did* talk to him an hour ago, but I'm sorry to say that he is paralyzed." Although these truths may always sound cruel, stresses Ms. Epperson, it's important that the family face stark reality as quickly as possible because what you're doing is of necessity short-term therapy. "You don't have lots of time and you have to prepare them for what is now and what's going to be later on." Although the family may go through recurring periods of denial, they can't begin to mobilize their strengths until they get over this acute phase.

• *Remorse.* Here all the guilts and "if only's" pour out. "If only I hadn't given him the car." "If only I hid the gun." "If only I bought new tires." Working with the family as a group can have many advantages, for they frequently can help each other over the various phases, but whether you work with them together or individually, the most important thing is to foster trust in you. "They're wondering what you think of them and they need your reassurance that they're okay people. Not by saying such things as 'You're a fine man and it was all an accident'; that won't be helpful to him. These people have to be able to say it themselves and be able to say it more than once. Your job is to try to get them to the point where they can say there was nothing, or very little, they could have done to prevent whatever happened. You have to help them build a rationale for why they didn't buy those new tires, why they let him have the car."

• *Grief.* Once the reality of the injury sets in, they not only grieve for what this means to the patient but what it means to themselves. The only "treatment" is to give them support, let them know that it's perfectly normal to feel this way, to cry. In fact, if they're clinging to denial, look for clues that will help you bring on this healthy grieving. "They often start off with something 'outside themselves.' For instance, a mother will say, 'The neighbors are going to miss him so much,' or 'The children really love him.' Move right in with something like, 'Tell me about him. It sounds like he was really appreciated.' What you're trying to do is get them to say, 'I'm going to miss him like hell,' to localize the grief within themselves."

• *Anger.* This can take many forms, be covert or right out in the open. Frequently it goes in all different directions—the person who broke the news to them was rude; the staff, you included, did this or that. Although the anger may be difficult to take if it's directed at you, you've got to help them let it out; equally important, help them focus it on the right target. Was the caller actually wrong? What exactly did you or any of the staff do? You'll often find that the anger is really aimed at the *patient* but that the family had been too ashamed to admit it. "That damn kid!" they'll frequently burst out. "Why was he driving so recklessly?" "I told him if he continued to cut down those trees one would fall on him!" If the patient was actually at fault, let them know it's legitimate to be mad; if he wasn't, help them see this too, of course. The important thing is that if you don't help them deal with their anger and put it in its proper place, "you're going to have a lot of passive-aggressive angry

behavior when the patient returns home and it's going to cut down on his potential for rehabilitation."

The last phase—the one you're striving to help them reach—is where they start to become reconciled to what's happened; where even though they're still trying to work through their anger and grief, they're beginning at last to try to think of solutions to the terrible dilemmas they now face. Where can they turn for financial support now that the husband will have to spend months in a rehabilitation center? Who will take care of the children while the wife works? Where will they get the emotional strength to meet the patient's psychological and physical needs once he's returned to them? Ms. Epperson emphasizes that here, too, you and others on the staff can do much to help in the planning, offering advice, directing them to agencies.

One patient, one nurse

The nurses at the institute work closely with the family service division to prepare the family for the patient's homecoming. Indeed, since the family service staff isn't on duty all the time, the nurses are frequently the first ones to meet with the family. And in *all* cases a nurse talks to the family after the physician has given them the diagnosis, the main purpose being to offer further emotional support. Moreover, since the families aren't allowed to visit the patients during their stay in the critical care unit—primarily to avoid infection—the nurses keep in touch with them by phone.

Although your hospital's intensive care unit may not have anywhere near the number of nurses who staff the institute's unit—42—much of their philosophy and approach to trauma nursing care can still apply. They've found it to be extremely important, for example, to have one nurse in charge of each patient. After talking to the family and assessing the complete situation, she sets up the nursing plan and is responsible for it: if anyone wants to change it while she's off duty, he or she has to get in touch with her unless it's an emergency. The main advantage, says Jo Marie Walrath, head nurse in the critical care unit, is to ensure continuity of care; in many if not most hospitals, nursing plans can be altered by every shift. It makes life easier for the patient and his family.

"One time I stood by a cubicle," Ms. Walrath recalls, "and counted 26 people coming in contact with a patient—dieticians, laboratory technicians, and so on. What a primary nurse does is sort all of that out. Also, if the patient or his family want to discuss a problem they can contact her rather than having to go through ten other people, which is a big problem in nursing. If they have so many people to talk to they have nobody who really understands."

Although a critical care nurse obviously has to be highly adept at handling equipment and making fast assessments, Ms. Walrath warns that if your nurses *over*emphasize the technical aspects of their work it can also be deleterious to the patient.

"When I first came here three years ago, the nurses wanted to be sort of mini-doctors. They wanted to learn to do tracheostomies, put in subclavian lines, draw arterial blood gases. Well, I don't believe in that myself. That's the physician's role and we have the personnel to do it. The patient needs someone who *humanly* cares about him, somebody to talk to, to listen to, not only somebody who is equipment- and technique-oriented. Now we're finally at the stage here where the nurses don't want to learn just about everything a doctor does. They want to care for the patient on a human level and be coordinators of care."

Consequently, she adds, they're able to build a close relationship with these seriously injured and seriously troubled patients, hear problems and worries the patient might never have revealed. If he seems suicidal—and it's important to remember that many auto accidents are actually suicide attempts —or has any other problem the nurse feels she can't handle, she calls in the psychiatric nurse on the staff or psychiatrist Schnaper; but even so, her relationship with the patient has generally smoothed the way.

Finally, says Dr. Schnaper, soon after your patient's been admitted you should begin thinking about his discharge. Where can he best learn to use two prostheses? Should he go to a school for the blind right away? It's essential to start thinking of this early rather than to explore it with him toward the end of his stay. The sooner he's able to get at and vent his feelings —to you, a nurse, perhaps a psychiatrist—the easier the rehabilitation process will be. "Anyone in rehab work will tell you that unless a patient is psychologically ready and motivated he will not progress in his rehabilitation," affirms nurse Linda Summey, the institute's discharge planner. It's not enough, she says, to gently lift a patient into an ambulance and wish him well during his stay at a rehab center, pleased you've been able to save still another life. For unless you've helped prepare him emotionally to share a ward with six other paraplegics or to stare down a shiny artificial leg, he may curse the moment you gave him back his life.

No doubt about it. A trauma center like the Maryland Institute for Emergency Medicine within easy transportation distance from your community is something dearly to be desired. And if you're one of the great majority of American physicians, you're not going to get one in the near future. But the most exciting and positive finding to come out of this sophisticated and very specialized facility is that you already have practically everything you need right there in your own hands and your own very basically equipped emergency room. A few really simple innovations, a lot of practice in the standard techniques, and a serious effort to develop teamwork with your colleagues do not a great trauma unit make—but the badly smashed up patients who continue to be rushed to the "nearest hospital" will have a much better chance of making it if you're ready for them. □

NOTES ON A TRAUMA VICTIM

The call came in to the Maryland Institute for Emergency Medicine at 3:32 p.m. The local volunteer rescue squad was still trying to extricate the victim from her small car, which had gone out of control on the highway 15 miles outside of Baltimore, smashed into a tree, and burst into flames. The Maryland State Police helicopter was on the scene ready to fly the patient to the institute.

At 4:15 the patient arrives outside the institute. Dr. Julio I. Lemus, team leader, center, who met the helicopter, will stay with her for the next five hours. Initial clinical assessment: in shock; semicomatose; pupils reacting equally; hair on frontoparietal area singed to scalp; multiple abrasions; lacerations of scalp, thenar eminence of left hand, right medial thigh; fractures of mandible, left ribs, left metacarpals, left scapula.

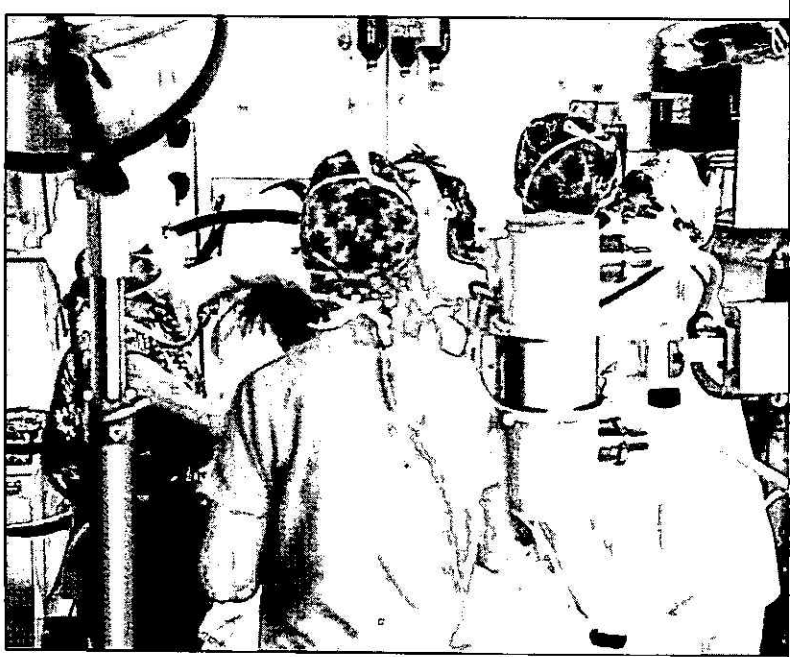
Dr. Lemus pauses in the midst of the "controlled chaos" to double-check the patient's status. Dr. Alberto H. Del Corro starts cutdown for one long IV line; a second has been inserted in right brachial vein for the CVP catheter. Blood-gas results—on sample from femoral artery stick—have already come down from the upstairs lab: metabolic acidosis with a base deficit of 5.

Intubated and put on the mechanical respirator with PEEP, lightly anesthetized, and with a third line now in the right saphenous vein, the patient is being readied for minilaparotomy by Dr. Wisit Boonnumsirikij while nurse Mary Kellogg inserts a Foley catheter. Plasma protein fraction is being run in through the left IV line. Central venous pressure is 11 mm. Hg.

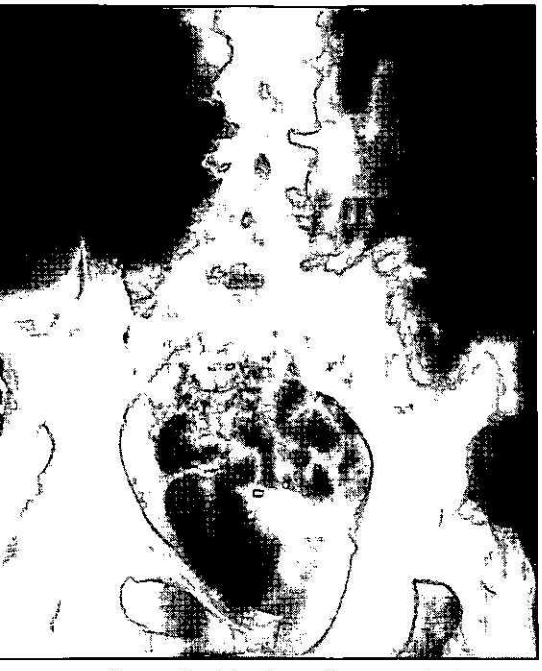
Purse-string sutures will pull the peritoneum around the lavage tubing to keep blood from the incision out of the peritoneal cavity.

Saline is flushed into the peritoneal cavity. Pink return is a signal for laparotomy but the patient is stable so x-rays of all suspected fractures will be taken first.

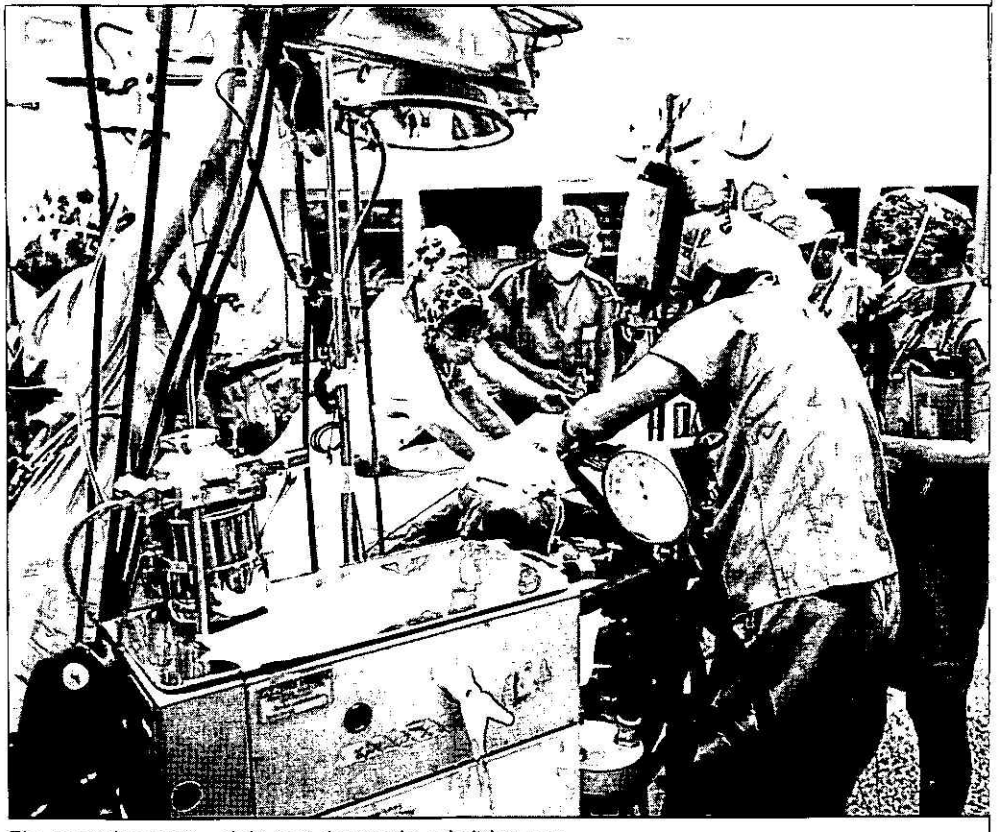
The very first shot is a cervical spine (above). With plate taped securely to the table and across patient's chin, Dr. Boonnumsirikij pulls patient's arms down to ensure visualization of C7. X-ray technician Jeff Pruett will process the film before the patient is moved for lateral and AP skull x-rays. In preparation for the chest film (right), the patient is lifted to sitting position with slight forward tilt by Dr. John K. Lee and nurses Kellogg and Carol Curran—at foot of the table—while Mr. Pruett places the plate behind her.



As the team gathers around the light box, Dr. Lemus points to patchy infiltration in the left lower lobe that may signal contusion. Skull film on right reveals left mandibular fracture.



X-ray of pelvis shows the suspected break and then some. Since there is no vascular or organ damage, the fractures will be left alone. Because the patient's urine was blood-tinged, IVPs were taken; both kidneys appeared normal, however, and subsequent clearing of urine suggested only slight contusion of the bladder.



The operating room—right next door to the admitting area, seen through window at far left—has been opened and the patient moved in by the whole team for "one-step" surgery.

The laparotomy begins. It will reveal a superficial 4-cm. laceration on the anterior surface of the left lobe of the liver. The surgeons will insert a sump drain near the laceration and let the lesion clot and heal unaided.

Before closing the incision, the surgeons cannulate and catheterize the patient's umbilical vein to make possible the taking of serial portograms at the patient's bedside through the postoperative period. They will also insert the catheter in her left femoral artery to monitor blood pressure.

While Drs. Lemus and Sarvotham Dhundshy—assisted by OR technician Ted Holt— complete the laparotomy, Dr. Jane Morgan, an oral surgery resident at the University of Maryland Hospital, wires the patient's jaw, and Dr. Boonnumsirikij sutures the lacerated hand.

Surgery completed, the stabilized patient is wheeled into the critical care recovery unit. The 12 beds, all but one filled with the arrival of this patient, are all within view of the raised central nursing station. Orders on the patient's chart: x-rays, including reverse Water's view, of mandible, left shoulder, and chest; hemoglobin and hematocrit every four hours, nasogastric tube and sump drain to suction; burn dressing to scalp, face, and left back; inform physician if urine output is less than 30 ml. an hour and hemoglobin less than 10 gm. Blood gases, electrolytes, and urinalysis every six hours is SOP.