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PRIORITIES OF RESUSCITATION

The patient is admitted directly from the heliport to one of the resuscitation areas in the unit which is shown in this slide.

Slide - Resuscitation Area

Area is small but has the advantage of having all the equipment necessary for resuscitation including emergency thoracotomy and laparotomy within easy reach. It is also just the right size for the resuscitation team to work unencumbered by other individuals. Two doctors, one nurse and one assistant work comfortably in this area during all the phases of resuscitation.

Slide - Initial Goals

Our first priority of resuscitation in the severely shocked patient is rapid stabilization of the cardiorespiratory systems. Once the means for this have been achieved then and only then are attempts made at specific and total diagnosis of the patient's injuries. Thirdly after this assessment of the critical and other injuries that the patient has, treatment will be carried out according to priorities.

Our first priority is cardiovascular respiratory stabilization.

Slide - Priority I Cardiovascular Respiratory Stabilization

For this we still obey the basic principles laid down in the early 1960's. Attending first to adequate ventilation then to infusion so that the oxygen can be carried to the tissues and thirdly to perfusion of the total patient.

Slide - Ventilation

Because mistakes can be made if procedures are complicated we have learned to rely on a simplified semi-rigid approach to all diagnostic and therapeutic measures carried out in this resuscitation area. Our assessment of the ventilatory needs of the patient is based on rapidly obtained clinical observation looking for cyanosis, moderate dyspnea, or the presence of shock. The first investigation of the patient admitted to the resuscitation area is a blood gas. The results of which are available from our own clinical laboratory within 90 seconds. Any patient who has clinical shock with a systolic blood pressure of less than 90 mmHg is intubated and a nasogastric tube inserted. Any moderate degree of respiratory embarrassment also is treated by intubation and continuous positive pressure ventilation with 50% oxygen.

Slide - Infusion I

Rapid placement of large central intravenous lines is crucial to adequate resuscitation in the severely shocked patient. If the anticubical vein is easily visible, a central venous line is immediately inserted there. However, if any trouble is encountered in this area no time is wasted in utilizing both subclavian veins to insert lines into the right atrium for resuscitation and measurement of the central venous pressure. Normally if two lines and two units of plasma given rapidly do not produce a rapid response in the systolic blood pressure and perfusion of the patient's cutdowns are done in the groin to the long saphenous veins which can be rapidly approached and into which are inserted large pediatric feeding tubes for rapid volume infusion.

Slide - Three Bottles of Plasma

Slide - Infusion II

We use colloid only for resuscitation. In the severely shocked patient, volume expansion is crucial and therefore only fluids that are kept well within the vascular space are used. Early use of blood given through pumps and warmed is also essential to maintain adequate oxygenation of the vital organs and of the periphery. It cannot be over emphasized that the CVP should be watched closely through all resuscitative maneuvers and in our resuscitation area, this is monitored on line.

Slide - Infusion III

Because individuals have made mistakes and given large quantities of plasma without attention to oxygen carrying capacity of the blood and have given large volumes of blood without attention to clotting factors, we have drawn up this semi-rigid protocol for use in our resuscitation area. Only five units of plasma are given and if the patient is still in shock then uncrossed matched O- or + blood is immediately put up. Grouped blood is given whenever it is available and crossed matched blood given as soon as possible.

For every ten units of blood we will give two units of fresh frozen plasma in an attempt to replace some of the clotting factors that have been lost with hemorrhage. For every twenty units of blood we also attempt to replace some of the platelets that have been lost.

Slide - Perfusion Therapy

Perfusion therapy can be complex but must essentially be tailored to the specific needs of the individual patient. We have relied heavily on the colloid volume challenge to assess whether or not hypervolemia is still present. A large number of pharmacological agents have been advocated in the treatment of shock and although we have found with adequate volume infusion there are relatively few indications for their use, there are specific indications for each of the many agents listed on this slide. However, I must stress that it is very rare that we use alpha blocking agents or beta stimulating drugs in this resuscitation area and it is almost unheard of to use vasoconstricting agents.

Slide - Priority II

Once the means for achieving cardiovascular stabilization and adequate ventilation have been achieved specific measures are taken to rapidly reach a diagnosis in these patients with multiple injuries. Besides a rapid complete physical examination to assess the total injuries, I want to specifically stress three diagnostic tests which we have found invaluable in these patients.

They are the upright chest x-ray, the abdominal lavage to diagnose intraperitoneal bleeding and the one shot carotid anteriogram as a screening test for intracerebral space occupying lesions. This latter examination is carried out in the resuscitation area using a single unilateral injection into a carotid artery. Anterior and posterior and lateral x-ray films are taken and these provide adequate evidence of a large intra-cranial lesion especially in the patient who requires urgent surgery for other injuries. They are not satisfactory for definitive diagnosis and when time is less pressing bilateral angiography is frequently performed.

Slide - Peritoneal Lavage

We have found that the abdominal tap a four quadrient tap is a useless investigation in the assessment of multiple trauma. It has a large percentage of false negative and false positive results and instead we have adopted the technique of peritoneal lavage descripted by Root in 1965. Using this test a negative lavage is significant contribution to the diagnosis in the patient. A positive lavage relates to maticulous technique and also to the quantity of blood in the peritoneal cavity.

Slide - Quantitative Peritoneal Lavage and Significance of Intra-abdominal Injury

This slide shows work presented by Olson et al in 1972. The amount of blood appearing in the tubing and in the one liter saline bottle that is infused into the abdominal cavity has been related to laparotomy findings. As can be seen 98% of those patients that have frank blood or obvious red colored discoloration of the lavage fluid have got significant intra-abdominal pathology. However, it is important to note that even if a trace or a small amount of blood appears in the lavage fluid 1/3 of those patients will have significant intra-abdominal injury. We feel that if a patient has a positive result following this diagnostic test that they should be submitted to laparotomy, and have happily accepted the very few cases in which no significant intra-abdominal pathology has been found at laparotomy. We feel that a negative laparotomy does not add to the mortality in these critically injured patients and that there is only a slight addition to morbidity and primarily from wound infection. We would like to compare this attitude to multiple trauma with the attitude taken to negative laparotomy for right lower quadrant pain earlier in this century and the subsequent reduction in death from appendicitis. The technique of abdominal lavage is important. We use under local anesthesia a small midline incision dissecting down to the peritoneum and placing a pursestring suture in the peritoneum. The peritoneum is held between two forceps and a small incision is made undervision. A peritoneal dialysis catheter is inserted through this hole into the pelvis and the pursestring suture pulled tight. One liter of isotonic crystaloid is infused into the abdominal cavity and left there for a short period of time and then allowed to siften out.

Slide - Specific Indications

The specific indications for the use of this useful diagnostic test are shown in this slide. They are obvious and we find ourselves making more and more use of this test in the assessment of the patient with multiple injuries. Carried out in the way I have described, it has virtually eliminated the incidence of delayed laparotomy for trauma in our Center.

It is of interest to define the areas in which major problems still exist in the management of these patients. Over the past five years we have developed techniques with which we feel we can resuscitate even the most severely shocked patient.

Slide - Major Problems

There are well defined areas in which we feel we still need to gain further expertise.

With the rapid placement of five or six large intravenous lines, it is rare for us not to be able to keep up with even the most profuse bleeding. However, transection of the aorta and other such injuries still require thoracotomy in the resuscitation area. Occasionally this is required with more expediency than is carried out. Hypoxia and anemia secondary to large volume plasma infusion have been corrected by adhering to the semi-rigid protocol for colloid infusion that I showed you earlier. Hypothermia from infusion of large volume frozen blood has recently been associated with cardiac arrest. So we feel that we can get the means for and resuscitate a large number of patients and transfer them rapidly to our operation rooms. The rapid hemostasis and securing the source of bleeding are still problems in specific areas. These are in the superior mediastinum, in the hepatic vein and retrohepatic interior vena cava and in cases of massive pelvic disruption with venous and arterial hemorrhage into the pelvic area. Bleeding disorders are also a problem even with the infusion of plasma early in the course of resuscitation. Postoperatively our major problems are bleeding, cerebral edema, shock lung, renal failure, hepatic failure and sepsis.

Slide - Wet Lung Syndrome

Although this syndrome has many names and is associated with a high mortality as can be seen from the recent figures from Vietnam and other places, we feel that our low incidence in mortality shown at the bottom of this slide are related to our aggressive prophylaxic attitude to ventialtion.

Slide - Shock Lung

Our overall incidence is now less than 3%. Aggressive use of continuous positive pressure ventialtion and using the lowest FIO_2 to maintain an adequate PaO_2 together with sedation and the alimen basic regimens we feel are important factors in reducing our incidence of this syndrome.

When it has occurred it has been related to prolonged hypoxia or to patients who have been removed from the continuous positive pressure ventilation for transport to x-ray or to operating rooms elsewhere in the hospital. Monitoring the pulmonary artery pressure and the alveolar arterial oxygen difference we have been able to pick some of these cases up early and treat them accordingly. The use of steroids is still controversial.

Slide - Renal Failure

Although we still see a lot of acute necrosis in our unit, aggressive prophylactic with mannitol and lasix probably prevents us from seeing more. Once established, we feel the only adequate treatment for acute tubular necrosis in the patient with multiple trauma is early hemodialysis. Using this we have obtained good results.

Slide - Sepsis

Sepsis is the perennial problem of units of this type that I have described here. Again a simple antibiotic policy is mandatory with minimal use of prophylactic broadspectrum antibiotics except in the cases where it is clearly indicated and widely accepted. This has cut down our incidence of selected resisted bacteria and we find it earlier to treat the bacteria that do appear with specific narrow spectrum bactericidal antibiotics.

Slide - Hepatic Failure

Now that we can cope with shock lung, renal failure, and many cases of sepsis, one problem that is recently becoming more prominent in our unit is that of hepatic failure occurring late after trauma about 5 - 14 days after the initial incidence. We have not yet defined what regimen might be useful in prophylaxis against this theoretically reversible situation but are using all the available therapeutic agents in treatment of this condition.