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Massive Transfusion Protocol

Massive blood transfusion results from trauma, surgical complications, cardiac surgery, extracorporeal membrane oxygenation, and other instances that require a large ratio of the patient blood volume to be replaced rapidly. With life threatening bleeding and hemorrhagic shock resuscitation using transfusion of red blood cells:plasma:platelets in a 1:1:1 unit ratio is recommended. This ratio is intended to minimized exacerbating a dilutional coagulopathy by replacing lost blood with plasma and platelet containing products instead of early and large amounts of crystalloids and RBC's. Massive transfusion is defined as more than 10 units of red blood cells in a period of 24 hours in an adult, or 70-80 ml/kg weight in a child during the same period of time. Massive transfusion protocols have been established for appropriate replacement of blood products which has been associated with an improved outcome. Using a balanced resuscitative approach to prevent and reverse severe shock and coagulopathy may decrease the risk of developing the complications of excessive crystalloids and RBC infusion such as anasarca, pulmonary edema, and abdominal compartment syndrome in patients who require massive transfusions. Massive transfusion protocol initiates with rapid surgical control of bleeding, followed by avoiding the overuse of crystalloids to minimize dilutional coagulopathy, continue monitoring of patient temperature (use fluid warmer and bear huggers), avoid the threat of hypothermia, avoid and managed acidosis as needed (pH < 7.2 treat with bicarbonate or THAM), and managed ionized calcium for hemostatic and hemodynamic effect. Massive transfusion protocol includes the preferential use of RBC with less than two days of storage which if older is associated with increased multiorgan failure and life-threatening hyperkalemia. Massive transfusion protocol is associated with increased plasma and decreased crystalloid use in the first 24 h, improved 24 h and 30-day survival, fewer thromboembolic events and decreased early death from hemorrhage when compared to historical control patients.

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Colorectal Injury

Colorectal injury secondary to trauma is rare in the pediatric age with an incidence of 0.3%, but carries a significant long-term morbidity if not managed appropriately. The larger incidence of colorectal injury occurs in military experience secondary to increase blast and high velocity trauma. Most colorectal injury in children occurs after blunt trauma when compared to penetrating injuries. Blunt trauma causing colorectal injury is the result of high velocity/high energy transfer associated with head, chest, solid organ and orthopedic injury. Those colorectal injuries associated with penetrating trauma are associated with an increase incidence of liver and small bowel injury. Fecal diversion (colostomy) is an important component in the management of colorectal injury. A tendency to primary repair has shown good results and diversion is usually performed when there is questionable viability of the colorectal tissues affected, there is concern that extraperitoneal rectal injury is present, high index of severity score or the child is hemodynamic unstable during the procedure. In the absence of shock, associated injuries, or gross fecal soiling primary repair or resection with anastomosis may be considered. Patients that are diverted are more likely to have concomitant injury, left sided colon injuries, shock and severe fecal contamination. The group that undergoes a colostomy has a higher morbidity and length of stay in the hospital. Colostomies have risk of their own such as second hospitalization and procedure for takedown, training of the patient in management, and psychological problems adjusting to the presence and use of the colostomy.

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Laparoscopic Meckel Diverticulectomy

Meckel diverticulum (MD) is a true diverticulum considered the most common congenital anomaly of the gastrointestinal tract. Most cases are clinically silent and found incidentally during abdominal exploration. The presence of a Meckel diverticulum can cause major clinical problems such as intestinal obstruction, gastrointestinal bleeding, acute intraabdominal inflammation, intussusception by acting as a leading point, and umbilical anomalies. Bleeding is the most common presentation of a Meckel

diverticulum in children. The diverticulum is located in the antimesenteric border of the ileum around 100 cm forms the ileocecal valve and can have three types of heterotopic tissue: pancreatic, gastric and colic. The gastric tissue can produce acid and create a bleeding ulcer in the wall of the ileum opposite to the diverticulum. Conventional surgical management of a complicated Meckel diverticulum has been open laparotomy and simple diverticulectomy (wedge excision) or segmental ileal resection with anastomosis. The advances in laparoscopy have significantly aided the diagnosis and surgical management of this disease with excellent cosmetic results, shorter hospitalization and less postoperative pain. There are two laparoscopic approaches to the complicated Meckel diverticulum: transumbilical laparoscopic-assisted Meckel diverticulectomy which allows exteriorization of the diverticulum through the navel and the performance of either segmental diverticulectomy or resection with anastomosis outside the abdomen. The second approach is a three port technique that requires the use of an endoscopic linear stapler-cutting device. Laparoscopy has also been used as first line of diagnostic technique in cases with persistent painless rectal bleeding not diagnosed by selective imaging in children. When performing a transverse stapling diverticulectomy the operator should be aware that a significant length between the heterotopic tissue and the resection should be present to avoid leaving behind gastric ectopic tissue with recurrence of bleeding. Stapler resection is contraindicated in broad-base or short Meckel bleeding diverticulum. The most common complication after diverticulectomy is adhesive bowel obstruction.

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