

Summary: A number of individual case series have suggested blunt traumatic thoracic aortic injury can be effectively managed with delayed repair. The stimulus for delayed repair undoubtedly resulted from dissatisfaction with the results of emergent operation, the greater availability of endografts, and more widespread use of β -blockers in the management of thoracic aortic trauma. This study reports data from the American Association for the Surgery of Trauma multicenter registry of 18 participating trauma centers. It was observational and prospective, and data were acquired from June 2005 through August 2007. Patients managed without aortic repair or who were in extremis at presentation were excluded. Data collected included clinical presentation, demographics, injury severity score, type of aortic injury, type of aortic repair, and time from injury to aortic repair. Patients were divided into groups according to early repair (≤ 24 hours) and delayed repair (> 24 hours). Outcomes were compared with multivariate analysis after adjustments for presence of hypertension, major associated injuries, and type of aortic repair, as well as Glasgow Coma Scale. Patients were also compared with delayed or early repair with respect to whether there were underlying major associated injuries.

The study included 178 patients with thoracic aortic injuries, of whom 109 (61.2%) underwent early repair and 69 (38.8%) underwent delayed repair. Demographics were similar in the two groups. Mortality was higher in the early repair group (adjusted odds ratio, 7.8; 95% confidence interval [CI], 1.69-35.70, $P = .008$). Complication rates were similar in the two groups, but delayed repair was associated with longer lengths of stay in the intensive care unit and in the hospital. Patients treated with early repair had a trend toward a higher mortality rate (adjusted odds ratio, 9.1; 95% CI, 0.9-93.8, $P = .064$). Early repair patients, however, had lower complication rates ($P = .04$) and shorter intensive care unit stays ($P = .02$) than delayed repair patients. There was a strong trend toward higher mortality in patients with major associated injuries treated with early repair (odds ratio, 9.4; 95% CI, 0.93-95.2; $P = .058$) without a difference in complication rates ($P = .239$).

Comment: Delayed repair of blunt thoracic aortic injuries appears to be safe but perhaps is associated with longer hospital lengths of stay and higher direct costs than earlier repair. Overall, previous studies and the current study suggest there is a survival advantage of delayed repair. Patients with major associated injuries seem to benefit most with delayed repair, with demonstrated improved survival and no increased systemic complications at the expense of a longer length of stay than early repair. The data support delayed repair in all patients with blunt thoracic aortic injuries irrespective of risk factors. Patients with major associated injuries are most likely to benefit from delayed repair.

Blunt Vertebral Artery Injuries in the Era of Computed Tomographic Angiographic Screening: Incidence and Outcomes From 8292 Patients

Berne JD, Norwood SH. *J Trauma* 2009;67:1333-8.

Conclusion: An aggressive screening and individualized treatment program for blunt vertebral artery injury can identify these injuries and results in potentially a low rate of preventable strokes and deaths.

Summary: When patients are screened aggressively for blunt vertebral artery injury (BVI) the incidence following appears to be 0.49% to 0.71% (Miller PR, et al. *Ann Surg* 2002;236:386-95; and Berne JD, et al. *J Trauma* 2006;60:1204-10). This rate of identification of BVI appears to be higher than in the prescreening era, where approximately 0.1% of patients with blunt injuries were identified with BVI (Thibodeaux LC, et al. *Br J Surg* 1997;84:94). Stroke rates associated with BVI have been reported at 24%, with BVI mortality rates of 8% (Biffl WL, et al. *Ann Surg* 2000;231:672-81). The authors sought to determine whether screening and treatment for BVI resulted in improved outcomes.

There were 8292 trauma patients admitted to the authors' institution between June 23, 2000, and December 31 2007. Of these, 47 had BVI (3 bilateral), and 37 patients were treated with pharmacologic therapy, heparin, warfarin, or clopidogrel and aspirin. Treatment was with angiographic coiling in eight patients (18%) and endovascular stents in two (5%). Four had signs of cerebral ischemia, one of whom recovered completely and three died. The mortality rate in the patients with BVI was 16%, and the BVI-related mortality rate was 7%. Two patients with BVI-related mortality had bilateral vertebral artery occlusion or transection. A posterior circulation infarct developed in one patient after a unilateral vertebral dissection when it was felt pharmacologic therapy was contraindicated secondary to intracranial hemorrhage. Before the screening protocol in the authors' institution, BVI-related mortality was 0.75 cases/year, and during the study period it was 0.57 cases/year.

Comment: The criteria for screening in the study included basilar skull fractures, cervical spine injuries, severe facial fractures, and cervical hematomas or cervical abrasions, as well as a Glasgow coma score ≤ 8 and lateralizing neurologic signs and mechanism of hanging for the injury. All patients had sustained a high-speed deceleration incident or blunt cervical trauma, and 86.4% of the BVI patients were identified by screening criteria alone. Patients overall did well, with only one possibly preventable death from BVI. What this study tells us is that patients with BVI identified through screening

and treated with a variety of modalities will have low neurologic morbidity and mortality.

Changes in Red Blood Cell Transfusion Practice During the Turn of the Millennium: A Retrospective Analysis of Adult Patients Undergoing Elective Open Abdominal Aortic Aneurysm Repair Using the Mayo Database

Long TR, Curry TB, Stemmann JL, et al. *Ann Vasc Surg* 2010;24:447-54.

Conclusion: Change in transfusion practice, including the use of more autotransfusions and tolerance of lower perioperative hemoglobin levels, have not resulted in significant differences in perioperative morbidity or mortality in patients undergoing open abdominal aortic aneurysm (AAA) repair.

Summary: The average cost of the transfusion of a red blood cell (RBC) unit is \$153.68, and 14 million units of RBCs are transfused annually in the United States (Sullivan NT, et al. *Transfusion* 2007;47:385-94). Currently, there is also enthusiasm for reducing the number of transfused units because of reported increased morbidity and mortality with increased transfusions and reported increased infectious complications with increased transfusions. The authors sought to determine whether changes in transfusion practice during a two-decade study had any impact on perioperative morbidity and mortality in patients undergoing open elective AAA repair. The authors stratified patients undergoing open elective AAA repair into one of two transfusion-related groups. Early practice was defined as that between 1980 and 1982, and late practice was defined as between 2003 and 2006. Hemoglobin concentration and RBC transfusion were analyzed as continuous variables and compared between groups. Perioperative complications were compared, and data were age adjusted and analyses corrected for multiple comparisons.

Patients in the late practice group compared with those in the early practice group had lower intraoperative (mean, 10 ± 1.4 vs 11.5 ± 1.5 g/dL), postoperative (mean, 11.9 ± 1.4 vs 13.4 ± 1.5 g/dL), and discharge hemoglobin levels (mean, 10.8 ± 1.2 vs 12.5 ± 1.5 g/dL; $P < .0001$ for each variable). Fewer patients in the late practice group received intraoperative allogenic transfusions (46% vs 99%, $P < .0001$). There were also fewer total allogenic units transfused in the late practice group (mean, 1.7 vs 4.3, $P < .0001$). No patients in the early practice group had intraoperative autotransfusions, whereas intraoperative autotransfusions were used in 97% of the late practice patients ($P < .0001$). The incidence of perioperative morbidity and mortality was 40% ($n = 119$) in the late practice group and 35% ($n = 106$) in the early practice group ($P = .27$).

Comment: RBC transfusion is associated with worse outcomes in cardiac surgery patients and in patients experiencing acute coronary syndrome (Murphy GJ, et al. *Circulation* 2007;116:2544-52; and Rao SV. *JAMA* 2004;292:1555-62). However, a randomized trial in critically ill patients comparing liberal vs conservative RBC transfusion found no difference in survival with the two treatment strategies (Hebert PC, et al. *N Engl J Med* 1999;340:409-47). The current study also found no difference in major morbidity or mortality in patients undergoing AAA repair with respect to a changing transfusion policy using more conservative thresholds for transfusion. However, the patients did no worse, and given the expense occurred with each unit transfused, a more conservative policy for patients undergoing open AAA repair is at least indicated financially if not medically.

Damage Control Techniques for Common and External Iliac Artery Injuries: Have Temporary Intravascular Shunts Replaced the Need for Ligation?

Ball CG, Feliciano DV. *J Trauma* 2010;68:1117-20.

Conclusion: Temporary intravascular shunts (TIVSs) have replaced ligation as primary damage control for injuries to the common and external iliac artery. TIVs substantially eliminate the need for amputation in patients with these injuries and provide improved likelihood of survival.

Summary: Iliac artery trauma is highly lethal, with mortality rates ranging from 24% to 60% (Dente CJ, Feliciano DV. In: Feliciano DV, Mattox KL, Moore EE, editors. *Trauma*. 6th ed. New York: McGraw-Hill Medical; 2008. p. 737-57). Traditional damage control for iliac artery injuries has been ligation and was associated with a 50% amputation rate and up to a 90% mortality rate. The goal of this study was to identify the consequences of using ligation vs TIVS for common or external iliac artery injuries in damage control scenarios. From 1995 to 2008, patients with iliac artery injuries were identified at a level 1 trauma center and were analyzed for demographics and outcomes. There were 88 patients with iliac artery injuries, comprising 71 external and 17 common iliac artery injuries; of these, 72% were penetrating, and the median injury severity score (ISS) was 25. The mean hospital stay was 28 days. Nonsurvivors (73%) died of refractory shock within the first 24 hours. Ligation was used in 1 common (6%) and in 14 external (20%) iliac arteries, and TIVSs were used in 2 common (12%) and in 5 external (7%) iliac arteries. Ligation was practiced primarily between 1995 and 2005 and TIVS between 2005 and 2008. Patients undergoing ligation or TIVS had similar demographics and injuries.

Compared with patients who underwent ligation, patients receiving TIVS had fewer amputations (47% vs 0%) and fewer fasciotomy procedures (93% vs 43%; $P < .05$). Mortality was 72% in the ligation group vs 43% in the TIVS group. In the patients treated with a TIVS, no TIVS thrombosed, and the mean shunt time was 22.3 hours.

Comment: Temporary intravascular shunts have long been used as a method of temporarily restoring arterial circulation in patients with peripheral arterial injuries distal to the axillary crease and inguinal ligament. Prolonged use for maintaining arterial circulation after injuries at other sites is less recognized. The article indicates that a major vascular injury within the abdomen does not necessarily need to be acutely repaired in damage control situations. A shunt can be placed, the patient resuscitated, and the coagulopathy corrected, or the patient brought back to the operating room for interval repair of vascular and associated injuries. This may result in fewer amputations and improved survival.

Isolated Gastrocnemius and Soleal Vein Thrombosis: Should These Patients Receive Therapeutic Anticoagulation?

Lautz TB, Abbas F, Novis SJ, et al. *Ann Surg* 2009;251:735-42.

Conclusion: Isolated gastrosoleal venous thrombosis (IGSVT) is associated with a significant rate of venous thromboembolism (VTE), and this rate of VTE can be reduced with therapeutic anticoagulation.

Summary: Only a few studies have focused on optimal management of isolated IGSVT. The incidence and prevalence of IGSVT appears to be significant, accounting for 15% to 25% of patients with lower extremity thrombus on venous duplex examinations (*J Vasc Surg* 1999;30:787-91). However, very few studies have quantified the natural history of IGSVT and the effects of anticoagulation or no anticoagulation on IGSVT propagation or resolution. The authors reviewed 34,426 lower extremity venous duplex studies from their vascular laboratory during April 2002 to April 2007 and

found 784 patients with IGSVT in one or more limbs. Of these, 38 had concurrent contralateral DVT, and 296 lacked follow-up data and were excluded from analysis. Forty-four patients had a simultaneous confirmed diagnosis of PE and were analyzed separately because they might have had a deep venous thrombosis (DVT) that embolized. The remaining 406 patients with IGSVT in 452 limbs were included in the primary analysis. Mean follow-up of these patients was 7.5 ± 11 months. The left limb was affected in 47.3%, the right limb in 41.4%, and both limbs in 11.3%. Gastrocnemius veins were involved in 60.1%, soleal veins alone in 36.5%, and both gastrocnemius and soleal veins in 3.4%. VTE events, defined as axial DVT or pulmonary embolism, occurred in 76 patients (18.7%) after the diagnosis of IGSVT. Of that 18.7%, 3.9% was pulmonary embolism, 16.3% was DVT, and 1.5% was both PE and DVT. Incidence of VTE was 30% (36 of 119) and 27% (13 of 48) in patients who received no or prophylactic anticoagulation, respectively. Incidence of VTE was 12% (23 of 188) in patients treated with therapeutic anticoagulation ($P = .0003$). Lack of therapeutic anticoagulation ($P = .017$) and a history of VTE ($P = .011$) were independent predictors of subsequent VTE development in patients with initial IGSVT. IGSVT resolution during follow-up was 61.2% in patients treated with therapeutic anticoagulation but only 40% and 41% in patients treated with prophylactic or no anticoagulation, respectively ($P = .003$).

Comment: Accumulating data suggest IGSVT may not be benign, and its natural history may be favorably influenced by anticoagulation. However, there is no randomized study of the efficacy of anticoagulation in patients with IGSVT. In retrospective studies such as this, it may be that high-risk patients for treatment with anticoagulation may have therapy withheld, and those same risk factors contributed to the apparent adverse natural history of IGSVT. With increasing numbers of IGSVT being recognized, a multicenter randomized trial of the efficacy of anticoagulation in patients with IGSVT is required to guide therapy for this increasingly commonly recognized condition.