

· 标准与指南 ·

编者按：血流动力学不稳定骨盆骨折是急诊创伤领域的重大难题，具有很高的病死率和并发症率，早期快速有效地处理尤为重要。这需要每家医院制定和落实与医院级别相匹配的救治流程，并依赖于急诊、创伤、骨科、外科、放射介入、麻醉等多学科团队的高效协作。2015 年中华医学会急诊医学分会、中华医学会创伤学分会、中国医师协会急诊医师分会、中国医师协会创伤外科医师分会 4 个学会共同合作，组织国内相关学科的 200 多名专家，在 2011 年中华医学会急诊医学分会创伤学组专家共识的基础上进行重新修订，并同时于《中华急诊医学杂志》和《中华创伤杂志》发布，旨在为国内业者提供规范的指导，并希望在实践中不断完善。

## 血流动力学不稳定骨盆骨折急诊处理专家共识

中华医学会急诊医学分会 中华医学会创伤学分会  
中国医师协会急诊医师分会 中国医师协会创伤外科医师分会

血流动力学不稳定骨盆骨折通常是指钝性外力导致的骨盆骨折合并低血压（收缩压 $\leq 90$  mmHg, 1 mmHg = 0.133 kPa），并伴有需要大量输血（伤后 6 h 内需要输注 4 ~ 6 U 或以上的浓缩红细胞）、明显的碱缺失（ $\leq \sim 6$  mmol/L）或两者兼有。血流动力学不稳定骨盆骨折是各种高能量损伤导致死亡的主要原因之一，伤后 24 h 内的主要死亡原因是急性失血。随着损伤程度的增高，病死率不断升高，可达 40% ~ 65%。处理的关键在于迅速明确出血部位并尽快控制出血。

血流动力学不稳定骨盆骨折的急诊处理充满挑战，当前在国内也存在着较多的争议。本共识是提供共性的框架性建议，而对个体患者的具体处理还需要综合当时的病情、可用的资源而综合考虑。

### 1 多学科团队与诊治流程

处理血流动力学不稳定骨盆骨折需要医院建立一个多学科的团队即创伤小组，包括急诊医学科、创伤外科、骨科、普通外科、放射科/介入治疗科、麻醉科、重症医学科、输血治疗科等相关学科，通过制定并落实与医院救治能力相匹配的创伤小组启动标准和诊治流程，可以有效地提高救治效果。

创伤小组成员应该具有所在专业高年资主治医师以上的资格，并接受过美国高级创伤生命支持（advanced trauma life support, ATLS）之类急救课程的培训。创伤小组需要指定明确的组长，其应该掌握扎实的创伤救治理论知识，有着丰富的严重创伤救治的临床经验，并具有较强的组织协调能力，能够有效组织指挥从急诊室 - 手术室/导管室 - ICU（intensive care unit, 重症监护病房）的整个救治过程。对于需要手术/放射介入止血的骨盆骨折患者，要

尽最大努力缩短受伤与手术/放射介入治疗之间的时间。

### 2 紧急伤情评估与处理

(1) 遵循高级创伤生命支持的评估和处理原则，立即进行快速评估并优先处理危及生命的问题，包括紧急的气道管理、呼吸和循环的评估与支持。对于血流动力学不稳定且怀疑有骨盆骨折的患者，不应该过多搬动，禁忌行骨盆挤压-分离试验，并尽早使用骨盆带固定。

(2) 急诊创伤复苏单元应配置床旁 X 线摄片机和超声机。严重创伤患者到达后尽快拍摄前后位的骨盆片和胸片，完成针对创伤的超声快速评估（focused assessment with sonography for trauma, FAST），明确腹腔、胸腔和心包腔有无大量积液。如有紧急剖腹/剖胸手术指征，应立即送往手术室。

(3) 对于血流动力学不稳定的患者，诊断性腹膜腔穿刺（diagnostic peritoneal aspiration, DPA）诊断性腹腔灌洗（diagnostic peritoneal lavage, DPL）也是排除腹腔内出血的有效手段。DPA 的穿刺点建议选择选择在脐以上水平，避免穿到腹膜后血肿。

(4) CT 已经成为严重创伤救治中非常重要的检查手段，尤其是增强 CT 检查可以很好地诊断/排除骨盆骨折伴随的大出血。医院应具备 24 h 开展增强 CT 检查的条件，建议尽可能紧邻创伤复苏单元设置 CT 室。如果两者相距较远，必须充分评价转送 CT 检查的利弊，并保证转送和检查期间能够连续获得与复苏室相当的监测与治疗强度。CT 检查之前须制定预案，保证 CT 扫描完成即可以立即采取下一步的措施，直接送至手术室、导管室或者 ICU。

(5) 骨盆骨折可合并全身其他部位的损伤，要注意充分和全面的评估。尤其需关注合并直/结肠、泌尿生殖系统的损伤，导尿和肛门指检是简单有效的手段。

### 3 损伤控制复苏 (damage control resuscitation, DCR)

(1) 骨盆骨折合并血流动力学不稳定者需尽快开始液

体治疗, 优选上肢的外周静脉通路 2~3 条, 条件允许时可考虑颈内/锁骨下静脉置管。初始应用晶体液治疗, 如果合并重型颅脑损伤 (格拉斯哥昏迷评分  $\leq 8$  分), 避免选用低渗溶液如乳酸林格液。如果应用人工胶体液, 建议在其处方剂量范围之内, 并警惕对凝血功能和肾损伤的影响。及时输注红细胞悬液, 维持血红蛋白为 70~90 g/L。

(2) 对于需要手术或者放射介入治疗止血的患者, 建议未控制出血前将收缩压控制在 80~90 mmHg, 直至确定性止血后进行充分的复苏。如果合并重型颅脑损伤, 建议将平均动脉压维持在 80 mmHg 以上, 并尽最快的速度完成确定性止血。对液体复苏无效的患者, 使用缩血管药物来维持目标的动脉血压。对于心功能不全的患者, 可使用正性肌力药物。

(3) 对于大出血患者应尽早 (伤后 3 h 内) 使用氨甲环酸针, 首剂 1 g 经静脉微泵给药 (持续大于 10 min), 后续 1 g 持续静脉输注超过 8 h。建议在创伤复苏单元储备氨甲环酸针, 有条件的地区可以考虑在救护车中即开始使用。

(4) 推荐早期采取综合措施减少体热丢失, 对输注的液体进行加温, 以维持正常的体温。

(5) 积极纠正代谢性酸中毒。动态监测血乳酸或碱缺失水平, 是评估出血和休克程度的敏感指标。常规监测血浆离子钙水平, 并维持在正常范围。

(6) 常规和动态监测凝血功能, 建议开展血栓弹力图检查, 积极防治创伤性凝血病。对于大出血的患者, 推荐早期应用血浆、凝血酶原复合物、纤维蛋白原。血浆纤维蛋白原水平  $\leq 1.5 \sim 2.0$  g/L 或血栓弹力图提示纤维蛋白原功能低下, 予以输注纤维蛋白原或冷沉淀, 起始剂量纤维蛋白原为 3~4 g, 冷沉淀为 50 mg/kg。输注血小板以维持血小板计数大于  $50 \times 10^9 \text{ L}^{-1}$ , 对于持续出血和/或创伤性脑损伤者, 建议将血小板计数维持在  $100 \times 10^9 \text{ L}^{-1}$  以上, 输注的起始剂量为 4~8 单位血小板。对于严重出血的患者, 有较多研究建议输注红细胞: 血浆: 血小板的比例达到 1:1:1, 至少血浆: 红细胞达到 1:2, 但对于没有大出血者使用过多血浆反而增加脏器功能不全的几率。建议医院建立大量输血治疗预案 (massive transfusion protocol, MTP), 确保能够及时输注血液制品。

(7) 对于已经采取标准的控制出血的努力和最佳的传统止血措施的患者, 如果持续存在大出血和创伤性凝血病, 可考虑使用基因重组的活化 VII 因子 (rFVIIa)。

## 4 骨盆固定

对于骨盆环不稳定的骨盆骨折, 应尽快维持骨折的稳定性。稳定骨盆可以减少骨折端移位和缩小盆腔容量, 有利于减少出血, 降低患者后续搬动/翻身带来的风险。稳定骨盆的措施包括骨盆带和支架外固定两类。

### (1) 骨盆带。

①对于血流动力学不稳定而临床怀疑骨盆骨折的患者, 可考虑在 X 线摄片明确之前尽早使用骨盆带固定, 甚至在院前就开始使用。

②如果 FAST 结果阴性而患者血流动力学不稳定, X 线摄片提示骨盆后环增宽或耻骨联合分离, 可先行无创性的骨盆带固定, 后续根据实际条件再考虑支架外固定。需要注意的是, 对于侧方挤压型损伤或耻骨支骨折, 骨盆带固定有可能加重损伤。

③骨盆带固定可采用普通的床单紧紧包裹后以大血管钳扣住或打结, 也可使用专门的骨盆带。要以大转子为中心并包裹臀部, 双膝靠拢并固定。骨盆带固定后应及时复查 X 线摄片, 避免过度包扎导致骨折端错位。包扎的持续时间不超过 36 h, 要防止损伤部位或骨性突出处的皮肤坏死。

### (2) 支架外固定。

①外固定支架包括前环外固定架和 C 形钳 (C-clamp) 两类。前者用于固定骨盆前环的不稳定, 常见的有耻骨联合分离、耻骨支骨折; 后者适用于固定骨盆后环的不稳定, 常见的有骶髂关节分离、骶骨骨折等。

②外固定支架是一种可以快速完成的骨折外固定技术, 适用于紧急情况下不稳定骨盆骨折的临时性固定, 对部分患者也可作为确定性的治疗选择。可以在急诊室或者手术室完成。

## 5 腹膜外填塞/剖腹探查手术

(1) 腹膜外填塞作为血流动力学不稳定骨盆骨折多学科处理的综合措施之一, 不仅对于静脉丛及骨折断端的止血效果确切, 而且对中小动脉损伤出血也有较好的止血效果。即使作为挽救性止血手段也有效, 可以在没有条件进行急诊血管栓塞、或者血管栓塞后有继续出血时采用。

(2) 腹膜外填塞可在急诊室床旁或者手术室进行。对于剖腹探查患者, 可以直接进行填塞, 使填塞物压迫髂内动脉分支与骶前静脉丛。对于非剖腹手术的患者, 可在耻骨联合上方做直切口, 用牵开器向对侧拉开膀胱, 探查骨盆缘并小心徒手分离, 避免撕裂髂血管和闭孔血管之间的分支。沿骨盆边缘尽可能深地向后方依次填入三块大纱布: 第一块大纱布置于最深处, 骶髂关节的下方; 第二块置于骨盆窝的中部, 第一块纱布的前方; 第三块置于耻骨后方、膀胱外侧的间隙。在完成一侧填塞后将膀胱拉向同侧, 再同法填塞对侧。

(3) 骨盆骨折合并腹腔脏器损伤的几率为 16%~55% 不等, 如明确或者高度怀疑存在腹腔脏器损伤 (大出血或者空腔脏器损伤), 需尽快送手术室进行剖腹探查。如果剖腹探查时考虑后腹膜血肿是动脉性的大出血, 应考虑打开后腹膜进行探查。对未能发现明确大出血的血管而有持续出血者, 可行双侧髂内动脉结扎, 也是一种简单地控制出血的手段。如果髂内动脉结扎后仍未控制出血, 还可行腹膜外填塞止血。

(4) 如果腹膜外填塞止血有效, 建议在 48~72 h 之内去除纱布。如果纱布移除后又有持续出血, 则予以重新填塞, 并考虑行增强 CT 检查。

## 6 血管造影/栓塞

(1) 在排除非骨盆来源的出血后, 骨盆骨折患者在稳定骨盆和积极复苏后仍有血流动力学不稳定或进行性出血的征象, 应考虑行骨盆血管造影/栓塞。

(2) 大于 60 岁的严重骨盆骨折 (翻书样、蝴蝶样或垂直剪切型损伤) 患者, 不管血流动力学状况如何, 均应考虑到血管造影/栓塞的可能性, 情况允许可先行骨盆增强 CT 检查。

(3) 对于符合指征的患者, 应尽快开始血管造影和栓塞治疗。对于临床怀疑动脉性出血的骨盆骨折, 如果患者病情和 CT 检查的条件允许, 可以先行增强 CT 检查, 以帮助



执笔: 赵小纲 张茂

主要审稿专家 (排名不分先后): 于学忠 姜保国 张连阳 白祥军 吴新宝 周东生 王天兵 赵晓东 桑锡光 都定元 帕尔哈提·拜合提 易成腊 干建新 李小刚 李子龙 赵刚 邓进 晁明 梁廷波 潘志军 黄宗坚 黄明伟 严敏 周文 赵光锋 胡培阳 陈大庆 陈玉国 童朝阳 杨光田 杨晓明 陈寿权 曹钰 楚英杰 朱长清 何新华 张劲松 冀兵

致谢: 中华医学会急诊医学分会、中华医学会创伤学分会、中国医师协会急诊医师分会、中国医师协会创伤外科医师分会、全军急救医学专业委员会、浙江省医学会急诊医学分会、浙江省医师协会急诊医师分会及上述学会多个学组全体委员的大力参与!

### 参考文献

- [1] Smith W, Williams A, Agudelo J, et al. Early predictors of mortality in hemodynamically unstable pelvic fractures [J]. *J Orthop Trauma*, 2007, 21 (1): 31-37.
- [2] Davis JW, Moore FA, McIntyre RC Jr, et al. Western trauma association critical decisions in trauma: management of pelvic fracture with hemodynamic instability [J]. *J Trauma*, 2008, 65 (5): 1012-1015.
- [3] Hou Z, Smith WR, Strohecker KA, et al. Hemodynamically unstable pelvic fracture management by advanced trauma life support guidelines results in high mortality [J]. *Orthopedics*, 2012, 35 (3): e319-324.
- [4] Cullinane DC, Schiller HJ, Zielinski MD, et al. Eastern Association for the Surgery of Trauma practice management guidelines for hemorrhage in pelvic fracture-update and systematic review [J]. *J Trauma*, 2011, 71 (6): 1850-1868.
- [5] Ip KC, Lee KB. Standardised multidisciplinary protocol for haemodynamically unstable pelvic fractures [J]. *J Orthop Surg (Hong Kong)*, 2014, 22 (2): 177-180.
- [6] Cheng M, Cheung MT, Lee KY, et al. Improvement in institutional protocols leads to decreased mortality in patients with haemodynamically unstable pelvic fractures [J]. *Emerg Med J*, 2015, 32 (3): 214-220.
- [7] Black SR, Sathy AK, Jo C, et al. Improved survival after pelvic fracture: 13 year experience at a single trauma center using a multidisciplinary institutional protocol [J]. *J Orthop Trauma*, 2015, Sep 3. [Epub ahead of print]
- [8] Stengel D, Rademacher G, Ekkenkamp A, et al. Emergency ultrasound-based algorithms for diagnosing blunt abdominal trauma [J]. *Cochrane Database Syst Rev*, 2015, 9: CD004446.
- [9] American Institute of Ultrasound in Medicine, American College of Emergency Physicians. AIUM practice guideline for the performance of the focused assessment with sonography for trauma (FAST) examination [J]. *J Ultrasound Med*, 2014, 33 (11): 2047-2056.
- [10] Spahn DR, Bouillon B, Cerny V, et al. Management of bleeding and coagulopathy following major trauma: an updated European guideline [J]. *Crit Care*, 2013, 17 (2): R76.
- [11] Caputo ND, Stahmer C, Lim G, et al. Whole-body computed tomographic scanning leads to better survival as opposed to selective scanning in trauma patients; a systematic review and meta-analysis [J]. *J Trauma Acute Care Surg*, 2014, 77 (4): 534-539.
- [12] Jiang L, Ma Y, Jiang S, et al. Comparison of whole-body computed tomography vs selective radiological imaging on outcomes in major trauma patients; a meta-analysis [J]. *Scand J Trauma Resusc Emerg Med*, 2014, 22: 54.
- [13] Huber-Wagner S, Mand C, Ruchholtz S, et al. Effect of the localisation of the CT scanner during trauma resuscitation on survival - a retrospective, multicenter study [J]. *Injury*, 2014, 45 Suppl 3: 76-82.

- [14] Hunt BJ, Allard S, Keeling D, et al. A practical guideline for the haematological management of major haemorrhage [J]. *Br J Haematol*, 2015, 170 (6): 788-803.
- [15] Perkins ZB, Maytham GD, Koers L, et al. Impact on outcome of a targeted performance improvement programme in haemodynamically unstable patients with a pelvic fracture [J]. *Bone Joint J*, 2014, 96-B (8): 1090-1097.
- [16] Holcomb JB, Tilley BC, Baraniuk S, et al. Transfusion of plasma, platelets, and red blood cells in a 1: 1: 1 vs a 1: 1: 2 ratio and mortality in patients with severe trauma: the PROPPR randomized clinical trial [J]. *JAMA*, 2015, 313 (5): 471-482.
- [17] CRASH-2 collaborators, Roberts I, Shakur H, et al. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised controlled trial [J]. *Lancet*, 2011, 377 (9711): 1096-1101.
- [18] Hunt H, Stanworth S, Curry N, et al. Thromboelastography (TEG) and rotational thromboelastometry (ROTEM) for trauma induced coagulopathy in adult trauma patients with bleeding [J]. *Cochrane Database Syst Rev*, 2015, 2: CD010438.
- [19] Georgiou C, Neofytou K, Demetriades D. Local and systemic hemostatics as an adjunct to control bleeding in trauma [J]. *Am Surg*, 2013, 79 (2): 180-187.
- [20] Zatta A, Mcquillen Z, Kandane-Rathnayake R, et al. The Australian and New Zealand Haemostasis Registry: ten years of data on off-licence use of recombinant activated factor V II [J]. *Blood Transfus*, 2015, 13 (1): 86-99.
- [21] Moran CG, Forward DP. The early management of patients with multiple injuries: an evidence-based, practical guide for the orthopaedic surgeon [J]. *J Bone Joint Surg Br*, 2012, 94 (4): 446-453.
- [22] Verbeek DO, Sugrue M, Balogh Z, et al. Acute management of hemodynamically unstable pelvic trauma patients; time for a change Multicenter review of recent practice [J]. *World J Surg*, 2008, 32 (8): 1874-1882.
- [23] Bodden J. Treatment options in the hemodynamically unstable patient with a pelvic fracture [J]. *Orthop Nurs*, 2009, 28 (3): 109-114.
- [24] Magnone S, Cocolini F, Manfredi R, et al. Management of hemodynamically unstable pelvic trauma; results of the first Italian consensus conference (cooperative guidelines of the Italian Society of Surgery, the Italian Association of Hospital Surgeons, the Multi-specialist Italian Society of Young Surgeons, the Italian Society of Emergency Surgery and Trauma, the Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care, the Italian Society of Orthopaedics and Traumatology, the Italian Society of Emergency Medicine, the Italian Society of Medical Radiology -Section of Vascular and Interventional Radiology- and the World Society of Emergency Surgery) [J]. *World J Emerg Surg*, 2014, 9 (1): 18.
- [25] Yoon W, Kim JK, Jeong YY, et al. Pelvic arterial hemorrhage in patients with pelvic fractures; detection with contrast-enhanced CT [J]. *Radiographics*, 2004, 24 (6): 1591-1605.
- [26] Mauffrey C, Cuellar DO, 3rd, Pieracci F, et al. Strategies for the management of haemorrhage following pelvic fractures and associated trauma-induced coagulopathy [J]. *Bone Joint J*, 2014, 96-B (9): 1143-1154.
- [27] Rajab TK, Weaver MJ, Havens JM. Videos in clinical medicine. Technique for temporary pelvic stabilization after trauma [J]. *N Engl J Med*, 369 (17): e22.
- [28] Tan EC, van Stigt SF, van Vugt AB. Effect of a new pelvic stabilizer ( T-POD ) on reduction of pelvic volume and haemodynamic stability in unstable pelvic fractures [J]. *Injury*, 2010, 41 (16): 1239-1243.
- [29] Chesser TJS, Cross AM, Ward AJ. The use of pelvic binders in the emergent management of potential pelvic trauma [J]. *Injury*,

- 2012, 43 (2): 667-669.
- [30] Poenaru DV, Popescu M, Anglitoiu B, et al. Emergency pelvic stabilization in patients with pelvic posttraumatic instability [J]. *Int Orthop*, 2015, 39 (5): 961-965.
- [31] Hu SB, Xu H, Guo HB, et al. External fixation in early treatment of unstable pelvic fractures [J]. *Chin Med J (Engl)*, 2012, 125 (8): 1420-1424.
- [32] Abrassart S, Stern R, Peter R. Unstable pelvic ring injury with hemodynamic instability: what seems the best procedure choice and sequence in the initial management [J]. *Orthop Traumatol Surg Res*, 2013, 99 (2): 175-182.
- [33] Sadri H, Nguyen-Tang T, Stern R, et al. Control of severe hemorrhage using C-clamp and arterial embolization in hemodynamically unstable patients with pelvic ring disruption [J]. *Arch Orthop Trauma Surg*, 2005, 125 (7): 443-447.
- [34] Cothren CC, Osborn PM, Moore EE, et al. Preperitoneal pelvic packing for hemodynamically unstable pelvic fractures: a paradigm shift [J]. *J Trauma*, 2007, 62 (4): 834-839.
- [35] Hornez E, Maurin O, Bourgouin S, et al. Management of exsanguinating pelvic trauma: Do we still need the radiologist [J]. *J Visc Surg*, 2011, 148 (5): e379-e384.
- [36] Tai DK, Li WH, Lee KY, et al. Retroperitoneal pelvic packing in the management of hemodynamically unstable pelvic fractures: a level I trauma center experience [J]. *J Trauma*, 2011, 71 (4): 79-86.
- [37] Li Q, Dong J, Yang Y, et al. Retroperitoneal packing or angioembolization for haemorrhage control of pelvic fractures-Quasi-randomized clinical trial of 56 hemodynamically unstable patients with Injury Severity Score  $\geq 33$  [J]. *Injury*, 2015, pii: S0020-1383 (15) 00587-2.
- [38] Nicodemo A, Decaroli D, Pallavicini J, et al. A treatment protocol for abdomino-pelvic injuries [J]. *J Orthop Traumatol*, 2008, 9 (2): 89-95.
- [39] Thorson CM, Ryan ML, Otero CA, et al. Operating room or angiography suite for hemodynamically unstable pelvic fractures [J]. *J Trauma Acute Care Surg*, 2012, 72 (2): 364-370.
- [40] DuBose J, Inaba K, Barmparas G, et al. Bilateral internal iliac artery ligation as a damage control approach in massive retroperitoneal bleeding after pelvic fracture [J]. *J Trauma*, 2010, 69 (6): 1507-1514.
- [41] Klein EN, Kirton OC. Angioembolization: indications, approach and optimal use [J]. *Curr Trauma Rep*, 2015, 1 (1): 26-34.
- [42] Ierardi AM, Piacentino F, Fontana F, et al. The role of endovascular treatment of pelvic fracture bleeding in emergency settings [J]. *Eur Radiol*, 2015, 25 (7): 1854-1864.
- [43] Marzi I, Lustenberger T. Management of bleeding pelvic fractures [J]. *Scand J Surg*, 2014, 103 (2): 104-111.
- [44] Fang JF, Shih LY, Wong YC, et al. Repeat transcatheter arterial embolization for the management of pelvic arterial hemorrhage [J]. *J Trauma*, 2009, 66 (2): 429-435.
- [45] Velmahos GC, Chahwan S, Hanks SE, et al. Angiographic embolization of bilateral internal iliac arteries to control life-threatening hemorrhage after blunt trauma to the pelvis [J]. *Am Surg*, 2000, 66 (9): 858-862.
- [46] Matityahu A, Marmor M, Elson JK, et al. Acute complications of patients with pelvic fractures after pelvic angiographic embolization [J]. *Clin Orthop Relat Res*, 2013, 471 (9): 2906-2911.
- [47] Brun J, Guillot S, Bouzat P, et al. Detecting active pelvic arterial haemorrhage on admission following serious pelvic fracture in multiple trauma patients [J]. *Injury*, 2014, 45 (1): 101-106.
- [48] Tanizaki S, Maeda S, Matano H, et al. Time to pelvic embolization for hemodynamically unstable pelvic fractures may affect the survival for delays up to 60 min [J]. *Injury*, 2014, 45 (4): 738-741.
- [49] Morshed S, Knops S, Jurkovich GJ, et al. The impact of trauma-center care on mortality and function following pelvic ring and acetabular injuries [J]. *J Bone Joint Surg Am*, 2015, 97 (4): 265-272.
- [50] Morozumi J, Homma H, Ohta S, et al. Impact of mobile angiography in the emergency department for controlling pelvic fracture hemorrhage with hemodynamic instability [J]. *J Trauma*, 2010, 68 (1): 90-95.
- [51] Kirkpatrick AW, Vis C, Dubé M, et al. The evolution of a purpose designed hybrid trauma operating room from the trauma service perspective: the RAPTOR (Resuscitation with Angiography Percutaneous Treatments and Operative Resuscitations) [J]. *Injury*, 2014, 45 (9): 1413-1421.
- [52] Kataoka Y, Minehara H, Kashimi F, et al. Hybrid treatment combining emergency surgery and intraoperative interventional radiology for severe trauma [J]. *Injury*, 2015. pii: S0020-1383 (15) 00560-4.
- [53] Tosounidis TI, Giannoudis PV. Pelvic fractures presenting with haemodynamic instability: treatment options and outcomes [J]. *Surgeon*, 2013, 11: 344-351.
- [54] Martinelli T, Thony F, Decléty P, et al. Intra-aortic balloon occlusion to salvage patients with life-threatening hemorrhagic shocks from pelvic fractures [J]. *J Trauma*, 2010, 68 (4): 942-948.
- [55] Saito N, Matsumoto H, Yagi T, et al. Evaluation of the safety and feasibility of resuscitative endovascular balloon occlusion of the aorta [J]. *J Trauma Acute Care Surg*, 2015, 78 (5): 897-903.
- [56] Moore LJ, Brenner M, Kozar RA, et al. Implementation of resuscitative endovascular balloon occlusion of the aorta as an alternative to resuscitative thoracotomy for noncompressible truncal hemorrhage [J]. *J Trauma Acute Care Surg*, 2015, 79 (4): 523-532.
- [57] Qasim Z, Brenner M, Menaker J, et al. Resuscitative endovascular balloon occlusion of the aorta [J]. *Resuscitation*, 2015, 96: 275-279.
- [58] Juillard CJ, Mock C, Goosen J, et al. Establishing the evidence base for trauma quality improvement: a collaborative WHO-IATSIC review [J]. *World J Surg*, 2009, 33 (5): 1075-1086.
- [59] Sarkar B, Brunsvold ME, Cherry-Bukoweic JR, et al. American College of Surgeons' Committee on Trauma Performance Improvement and Patient Safety program: maximal impact in a mature trauma center [J]. *J Trauma*, 2011, 71 (5): 1447-1453.
- [60] Reiff DA, Shoultz T, Griffin RL, et al. Use of a bundle checklist combined with physician confirmation reduces risk of nosocomial complications and death in trauma patients compared to documented checklist use alone [J]. *Ann Surg*, 2015, 262 (4): 647-652.

(收稿日期: 2015-11-08)

(本文编辑: 何小军)