

·综述 General review·

胸主动脉钝性损伤诊治流程探讨

刘宇洲, 王庆, 蔡煌兴, 孙林, 谢勇, 向华

【摘要】 胸主动脉钝性损伤(BTAI)严重威胁创伤患者的生命,大部分患者在到达医院前死亡,到达医院的幸存者通常合并全身多发伤。由于此类疾病相对少见,且患者通常处于危重状态,目前我国对此类患者的诊断与救治存在诸多问题,严重影响患者的预后。本文综合国内外最新研究,结合自身经验,综述了 BTAI 诊断、分级、修复方式及时机,并总结了此类患者的诊治流程,旨在为临床实践提供参考,提高此类患者的预后水平。

【关键词】 胸主动脉; 损伤; 诊断; 修复时机; 流程

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Discussion on the diagnosis and treatment process of blunt thoracic aorta injury LIU Yuzhou, WANG Qin, CAI Huangxing, SUN Lin, XIE Yong, XIANG Hua. Department of Interventional Vascular Surgery, Affiliated First Hospital of Hunan Normal University (Hunan Provincial People's Hospital), Changsha, Hunan Province 410005, China

Corresponding author: XIANG Hua, E-mail: vipxiangh@163.com

【Abstract】 Blunt thoracic aortic injury (BTAI) seriously threatens the lives of the patients with trauma, most of the patients died before reaching the hospital, and the survivors who can reach the hospital in time often simultaneously have multiple systemic injuries. BTAI is relatively rare in clinical practice, and the patients are usually in critical condition. At present, there are many problems concerning the diagnosis and treatment of such patients in China, which seriously affect the prognosis of patients. Based on the latest research progress at home and abroad, and combined with the experience of domestic experts, this paper reviews the diagnosis, classification, repair mode and timing of BTAI, meanwhile, the diagnosis and treatment procedures of BTAI patients are also summarized, aiming to provide a reference for clinical practice and to improve the prognosis level of such patients. (J Intervent Radiol, 2023, 32: 1028-1033)

【Key words】 thoracic aorta; injury; diagnosis; repair timing; procedure

胸主动脉钝性损伤(blunt thoracic aortic injury, BTAI)是一种临床少见的危急重症。BTAI 在创伤患者中发病率约为 1%, 但仍是创伤患者中仅次于颅内出血的第二大死亡原因^[1-3]。据估计,这些患者中多达 80%在到达医院之前死亡,而被送到医院的幸存患者约 46%会在 24 h 内死亡^[4-5]。因此,快速、有效、准确的诊断有助于早期复苏和控制血压,这对在最终治疗前防止病情恶化至关重要。BTAI 通常由机动车事故或高处坠落所致高能量冲击,突然减速所形成的剪切力和拉伸力、血管内压力骤升以及

主动脉受压等因素共同作用所造成^[6]。开放性修复术在 20 世纪很长时间成为 BTAI 患者标准治疗,但此种治疗方式创伤大、时间长,具有较高的病死率和截瘫率。胸主动脉腔内修复术(thoracic endovascular aortic repair, TEVAR)因其较低的病死率和脊髓损伤发生率,被迅速应用于 BTAI 患者^[7]。由于 BTAI 患者的严重性和特殊性,采取随机对照试验对比两种手术方式的疗效非常困难,但大量队列研究和 Meta 分析结果均显示,TEVAR 相对于开放性修复术可明显改善 BTAI 患者预后,因此目前

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作者单位:410005 湖南长沙 湖南师范大学附属第一医院(湖南省人民医院)介入血管外科

通信作者:向华 E-mail: vipxiangh@163.com

的研究均推荐其作为 BTAI 患者标准治疗方式^[5,8-10]。然而 BTAI 患者通常病情危重,伴发损伤较多,甚至生命体征不平稳,如何迅速、全面、准确地诊断并确定主动脉损伤伴多发伤处理时机及顺序,对患者预后起着至关重要的作用。本文就国内外相关研究及自身经验,对 BTAI 患者诊治流程加以探讨及总结。

1 诊断

1.1 临床表现

BTAI 患者约 50% 伴发严重的全身损伤,这些合并伤尤其是胸部损伤通常会掩盖主动脉损伤的临床表现,从而影响临床医师判断,造成 BTAI 诊断延误,甚至漏诊^[11-12]。尽管有一些研究试图寻找可帮助早期识别 BTAI 的因素,但目前尚无已知的临床表现能可靠地诊断或排除主动脉损伤,部分严重损伤患者无特异性临床表现,直至突然大出血造成出血性休克而死亡^[13-14]。因此,对外伤患者应警惕 BTAI 可能,尤其是对伴发胸部严重损伤(如胸椎爆裂骨折、胸骨骨折,第一、二肋骨骨折,气胸、血胸、连枷胸,气管支气管断裂和食管损伤)及既往有高血压病史患者更应警惕。体格检查结果对 BTAI 的敏感性和特异性较低,上肢高血压可能提示主动脉内膜剥离造成的伪缩窄^[15]。

1.2 影像学表现

胸部 X 线平片表现:许多胸部 X 线检查阳性结果均可能提示 BTAI 存在,但其敏感性和特异性尚不足以可靠地诊断或排除 BTAI。纵隔增宽是平片上最易识别,也是最能提示 BTAI 的表现之一,其余需警惕平片上气管或食管右偏、左主支气管下降、主动脉结影消失、左肺尖部胸膜外增宽、胸腔积液等表现^[15-16]。

超声表现:创伤超声重点评估(focused assessment with sonography for trauma, FAST)可快速提供关于心包、胸廓积液等信息,但对于评估纵隔内损伤(如胸主动脉损伤)仍有明显局限性。当 FAST 法无法提供所需信息时,经食管超声心动图(transesophageal echocardiography, TEE)是一种有价值的诊断工具,可用于快速诊断血流动力学不稳

定、怀疑 BTAI 患者,但 TEE 作为一种侵入性操作,在非全身麻醉状态下不建议常规实施^[17]。

CT 表现:随着 CT 技术发展,CTA 已取代主动脉造影成为诊断 BTAI 的首选方法^[18-19]。既往研究显示 CTA 诊断 BTAI 敏感性为 95%~100%,阴性预测值为 99%~100%^[18]。CTA 可发现 BTAI 损伤的直接和间接损伤征象。BTAI 最常见间接损伤征象为纵隔或主动脉周围血肿,当发现主动脉周围血肿而并未发现明确的主动脉损伤征象时,可考虑主动脉内膜出现了隐匿性损伤可能,同时还需鉴别其他部位(如纵隔静脉、肋间动脉等)出血,这些部位出血造成的血肿一般与主动脉间有清晰的脂肪间隙^[19-20]。BTAI 直接征象包括对比剂外溢、主动脉破裂、创伤性假性动脉瘤、腔内充盈缺损、主动脉夹层及主动脉轮廓异常等。对 BTAI 患者伴发损伤的评估也至关重要。BTAI 常见合并伤包括严重的头部损伤、肺和心脏损伤、膈肌破裂、腹内出血、盆骨和长骨骨折等^[21]。术前 CTA 检查报告内容是确定 BTAI 治疗计划的关键。CTA 报告应包括主动脉损伤位置和类型、主动脉弓解剖、双侧椎动脉情况、重要的动脉粥样硬化疾病或狭窄,重要的术后改变(如冠状动脉旁路移植术)、主动脉损伤长度以及左锁骨下动脉(left subclavian artery, LSA)起源等。

2 BTAI 分级

BTAI 分级(见表 1)在一定程度上反映了主动脉破裂风险,对决定治疗流程起着至关重要的作用。目前临床上应用最广泛的 BTAI 分级是 2009 年由 Azizzadeh 等提出,并已被美国血管外科协会(SVS)临床实践指南采用^[5,22],但此分级并未指出病变大小及形态,在指导治疗时存在一定缺陷。此后 Lamarche 等^[23]和 Heneghan 等^[24]分别提出 Vancouver 分级和 Harborview 分级,这两种分级加入更多细节(如损伤大小、稳定性等),可更好地指导治疗策略。Vancouver 分级具有较小的观察者间变异性,且少数研究已证实其与患者预后相关^[23,25],故本文中采用 Vancouver 分级,并同时结合近年来提出的轻微主动脉损伤(minimal aortic injury, MAI)进行阐述。

表 1 BTAI 分级

SVS 分级		Vancouver 分级		Harborview 分级	
I	内膜撕裂	I	内膜撕裂/壁间血肿/血栓<10 mm	轻微损伤	血栓/内膜撕裂/壁间血肿<10 mm(主动脉外部轮廓无异常)
II	壁间血肿	II	内膜撕裂/壁间血肿/血栓>10 mm	中度损伤	主动脉外部轮廓异常/内膜撕裂>10 mm
III	主动脉假性动脉瘤	III	假性动脉瘤(无对比剂渗出)		
IV	主动脉破裂	IV	对比剂外溢	严重损伤	对比剂外溢/左锁骨下动脉血肿>15 mm

3 治疗流程

3.1 急诊处理

BTAI 患者急诊处理,应遵循高级创伤生命支持(advanced trauma life support,ATLS)策略和技术^[26-27]。据统计,BTAI 患者入院时 49%左右会伴有血流动力学不稳定[收缩压<90 mmHg(1 mmHg=0.133 kPa)]^[14]。对于血流动力学不稳定患者,应至少建立 2 条大口径静脉通道,立即配血、输血,适当应用血管活性药物,并在复苏的同时排查有无梗阻性休克因素(血气胸、纵隔血肿及心包积液等),伴有活动性出血时应立即在抢救室条件下快速有效地控制活动性出血,及时纠正低氧血症及休克,避免“死亡三联征”(严重酸中毒、低体温、凝血功能障碍)发生,必要时急诊手术治疗。

对于血流动力学稳定患者,对主动脉损伤进行早期诊断仍有必要,诊断后应尽早进行血压及心率控制,以减少血管剪切应力,防止主动脉损伤加重,甚至破裂。在无禁忌证情况下,建议首选 β 受体阻滞剂(如艾司洛尔、美托洛尔)控制血压,必要时可联合钙离子通道阻滞剂、血管扩张剂等。收缩压目标为<100 mmHg,平均动脉压控制在 60~80 mmHg,并建议目标心率<100 次/min^[28],同时评估患者损伤情况确定下一步治疗方案。

3.2 MAI 与保守治疗

MAI 是一不断发展的概念,过去 MAI 被定义为<1 cm 内膜损伤(血栓或内膜撕裂)且不伴主动脉轮廓畸形^[29]。随着影像技术发展及车辆安全性提升,MAI 在 BTAI 患者中所占比例已由过去 10%左右提高至 25%~35%^[30-31]。随着保守治疗经验累积并基于部分病灶自愈或长期稳定,MAI 所包含内容在不断增加。虽然现在关于 MAI 定义尚未达成共识,但大部分研究认为<1 cm 内膜撕裂、腔内血栓或壁内血肿、无任何外部轮廓异常、伴有轻微或无主动脉周围血肿的损伤可被定义为 MAI^[30]。这类患者预后较好,大量研究显示其主动脉损伤大部分在 4~8 周内自愈,仅 10%~15%患者在随访过程中持续存在或出现进展^[3,32-39]。因此对经 CTA 评估主动脉损伤为 MAI 且血流动力学稳定患者,可采取严格控制血压及心率的保守治疗策略^[23]。在主动脉湍流环境中,部分血栓相关性内膜损伤患者血栓有脱落风险,这可能会栓塞到下游血管。Gunn 等^[31]发现 23 例 MAI 患者中有 4 例出现新发肾或脾脏梗死。但这种现象对这些患者总体死亡率的影响,目前并不十分明确。有学者建议 MAI 患者可使用抗

血小板药物,但必须考虑患者相关损伤出血的风险^[34]。主动脉影像学随访是评估保守治疗是否成功的关键,但关于随访策略并未达成共识。目前研究表明,大多数 MAI 患者在随访过程中无疾病进展,即使发生进展一般也在受伤后 4 周内^[33]。笔者建议在损伤后 1 周及 1 个月复查主动脉 CTA,如果主动脉损伤自愈或改善则不建议进一步影像学随访,对于持续存在但稳定的损伤可于伤后 6、12 个月及此后每年进行随访。随访过程中出现损伤等级提升,则需手术治疗。

3.3 修复方式及时机

BTAI 治疗方式主要是开放性修复及血管腔内修复。目前研究均表明,腔内修复相对于开放性修复可显著改善 BTAI 患者预后^[5,7-8,40]。因此,对于需要修复的 BTAI 患者,推荐使用腔内修复,除非存在无法进行腔内修复的情况:①主动脉损伤位置原因不宜行腔内修复。既往认为,损伤部位至 LSA 距离>15 mm 时,可获得足够的近端锚定区以维持支架的稳定,但随着腔内技术进步,近端锚定区不断扩展,TEVAR 适应证逐步拓宽^[41]。据研究报道,约 50%患者需要部分或完全覆盖 LSA 以获得足够的近端锚定区^[42]。尽管有研究证明覆盖 LSA 后短期内是安全的^[42-43],但长期后遗症尚未可知,且 LSA 覆盖可能会影响未来的透析通路,限制使用左胸廓内动脉行冠状动脉旁路移植术,以及可能发生锁骨下窃血综合征。因此建议尽量保留或重建 LSA,但并不提倡为了强行达到这一目标而影响支架放置^[44],而当损伤位于 LSA 开口前的主动脉弓及升主动脉时,则不适宜行腔内修复。②发生在年轻人中的 BTAI 一直是腔内修复的难点,此类人群平均主动脉管径通常较小,可能没有合适的支架选用,且年轻人主动脉弓部的几何形状更为尖锐及主动脉生长,这些因素均可增加支架内漏、折叠及塌陷的可能性^[45],因此不建议对主动脉直径过小或入路血管(髂动脉或股动脉)直径过小及年龄<20 岁患者行腔内修复^[40,46]。

BTAI 患者通常伴发全身多发伤,主动脉损伤和伴发伤处理时机和顺序直接决定了患者预后^[47-48]。SVS 研究表明,主动脉在损伤后 24 h 内破裂风险最高,因此建议应在患者损伤后 24 h 内紧急修复^[5]。美国东部创伤外科协会(Eastern Association for the Surgery of Trauma,EAST)研究发现,早期修复的死亡和截瘫风险高于延迟性手术修复,因此建议对低级别主动脉损伤(SVS 分级 I、II 级)采取延迟修

复^[49]。关于研究中得出的延迟修复相对于早期修复可改善预后这一结论,笔者认为可能有以下原因:①选择偏倚可能部分解释了这一点,因为被选择的延迟修复患者伴发损伤可能相对较轻;②一些研究发现创伤早期主动脉形态具有较大改变,急诊植入支架可能增加支架相关并发症发生率^[50-52];③随着保守治疗经验积累,主动脉破裂风险已较过去明显减低;④研究表明大多数 BTAI 患者死亡与主动脉损伤本身无关,而与其他损伤或院内感染有关,延迟修复患者可得到充分复苏,也有足够时间处理其他严重合并伤^[36,53]。

具体修复时机目前并无统一标准。笔者认为,主动脉修复时机取决于患者血流动力学状态、主动脉损伤及全身伴发损伤情况。面对 BTAI 患者,首先需考虑血流动力学状态。BTAI 患者出现血流动力学不稳定的原因,可分为主动脉相关性及非主动脉相关性^[14]。若患者血流动力学不稳定由主动脉损伤所引起,应立即修复损伤的主动脉,否则需迅速寻找其他引起血流动力学不稳定的原因并及时处理。对于血流动力学状态稳定患者,首先严格控制血压及心率,并评估主动脉损伤及全身合并伤情况,以决定修复时机。具体建议如下:①对Ⅳ级损伤,应急诊修复。②对Ⅲ级损伤目前存在较大争议。SVS 及 EAST 专家均建议紧急修复^[5,49],而有研究提出Ⅲ级主动脉损伤的延迟修复是安全的^[52],也有研究认为小的假性动脉瘤破裂风险较低,可采取保守治疗^[54-56]。笔者认为,目前临床证据尚不足以支持对Ⅲ级损伤采取保守治疗,因Ⅲ级损伤已累及主动脉外膜,无论损伤大小均应进行修复,对于小的假性动脉瘤(瘤体直径/病变两端正常主动脉直径 <1.4 mm)可考虑延迟修复,而对其余患者仍建议急诊修复。③Ⅱ级损伤大部分较为稳定,可采取延迟修复,但存在内膜剥离或壁间血肿造成主动脉假性缩窄^[49]及广泛内膜撕裂累及内脏分支血管或下肢血管引起缺血症状^[57]情况时,需及时进行紧急修复。④Vancouver 分级Ⅰ级并未考虑主动脉外部轮廓改变,外部轮廓损伤表明主动脉壁各层均有损伤,且不会自行愈合,故不推荐保守治疗^[24]。⑤主动脉损伤早期发生破裂风险较高,对于考虑延迟修复患者建议在损伤 24 h 内重复行影像学检查,若发现损伤进展,应予紧急修复^[5,15,32,38,58]。BTAI 诊治流程见图 1。

4 总结

BTAI 患者病情错综复杂且死亡率较高,目前尚

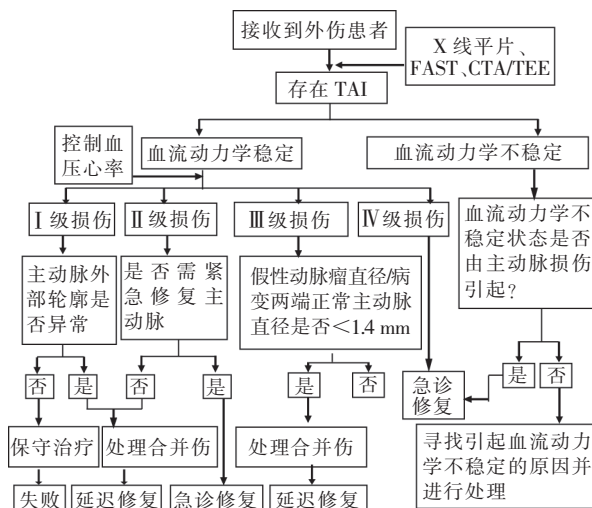


图1 BTAI 诊治流程

无详细的指南指导 BTAI 及其合并伤处理时机和顺序,且关于修复时机仍存在较大争议。本文综合国内外研究并结合自身经验探讨并总结了 BTAI 患者诊治流程,旨在提高此类患者的预后水平,但未来 BTAI 患者治疗方案仍需更多循证医学证据去进一步改进与完善,并且临床实际情况往往更为复杂。因此,我们认为 BTAI 患者救治还需遵循个体化治疗原则。

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欢迎投稿 欢迎订阅 欢迎刊登广告