·专家共识·

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中国脊柱手术加速康复——围术期管理策略专家共识

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【摘要】加速康复外科（enhanced recovery after surgery, ERAS）是基于循证医学证据的一系列围术期优化措施，以减少围术期的生理与心理创伤应激，减少并发症，达到加速康复的目的。但是目前针对脊柱手术尚无一整套ERAS体系协助患者从术前、术中到术后快速康复。通过查阅文献，遵循循证医学原则，经过全国专家组反复讨论，针对脊柱外科手术患者围术期管理达成共识，供广大脊柱外科医师在临床工作中参考应用。本共识主要内容包括：术前宣教、术前评估及管理、抗菌药物使用与皮肤准备、麻醉、手术技术、激素应用、围术期血液管理与输液管理、血栓预防、疼痛管理、术后消化道管理、切口引流管管理、尿管管理、术后康复锻炼和出院后管理。

【关键词】加速康复；脊柱手术；围术期管理

Expert consensus in enhanced recovery after spinal surgery in China: perioperative management

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【Abstract】Enhanced recovery after surgery (ERAS) is a series of perioperative optimization measures based on evidence-based medicine, in order to reduce perioperative physiological and psychological trauma stress and complications, and achieve accelerated rehabilitation. However, there is not a complete set of ERAS system for spinal surgery in China, which can help patients recover quickly. A thorough literature search was undertaken to examine the use of ERAS pathways in spinal surgery, and the results presented in this paper. This expert consensus mainly contains patients' education, pre-operative evaluation and management, antibiotics usage and skin preparation, analgesia, surgical techniques, steroids, perioperative blood and infusion management, venous thromboembolism (VTE) prophylaxis, pain management, post-operative management of the digestive system, drainage tube and ureter management, functional exercise and postoperative follow-up management.

【Key words】Enhanced Recovery After Surgery (ERAS); Spinal Surgery;Perioperative Management

加速康复外科（enhanced recovery after surgery, ERAS），又称快速康复，最早是由Henrik Kehlet在1997年提出的[1]。它是基于循证医学证据而采用的一系列围术期优化措施，以减少围术期的生理及心理创伤应激，减少并发症，达到加速康复的目的[2,3]。目前，ERAS已在胃肠外科、肝胆胰外科、心胸外科、

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妇产科及骨科关节置换手术等多个领域开展，为进一步推动ERAS在脊柱外科的应用，使更多脊柱外科医生了解ERAS的理念及具体措施，邀请了国内68位专家反复讨论，根据现有的临床经验和公开发表的相关资料，总结形成了以下共识，供广大脊柱外科医师在临床工作中参考和应用。

1 术前宣教

术前宣教是加速康复外科的重要组成部分，脊柱外科术前宣教需注意以下问题：

疼痛、畸形、功能障碍是脊柱疾病最常见的表现，互为因果。神经源性疼痛是脊柱疾病疼痛最重要的类型。术前进行疼痛的神经生理学知识宣教能使脊柱手术患者获得更好的术后疗效[4,5]。

脊柱患者由于长期疼痛、畸形及功能障碍，会影响患者心理健康，而心理疾病又会影响患者疼痛缓解。研究[6]表明，腰痛与抑郁存在明显相关性。心理状态对患者生活质量的影响甚至超过躯体疾病本身[7]，同时，抑郁症本身亦可表现为躯体疼痛、麻木、无力等不适，诊疗过程中应注意与之鉴别。

脊柱患者常伴有呼吸功能减退，术前进行呼吸功能练习可改善患者肺功能。颈椎前路手术由于术中牵拉，患者常出现术后咽部不适或吞咽困难。术前进行气管推移练习可减少术后吞咽困难的发生[8]。

吸烟可导致腰椎术后融合率下降，增加切口感染、术中出血及输血、硬膜外血肿、脑脊液漏、螺钉松动及全身并发症发生率，影响神经功能及疼痛恢复，从而延长住院时间、增加术后死亡率，降低患者满意率[9-14]。术前戒烟4周可降低49%的术后并发症发生风险[15]。

2 术前评估和管理

2.1 术前手术风险评估

生理能力与手术应激评分系统（the estimation of physiological ability and surgical stress, E-PASS）和死亡率及并发症发病率的生理学和手术严重程度评分系统（the physiological and operative severity score for the enumeration of mortality and morbidity, POSSUM）均能较好地预测脊柱手术患者术后并发症的发生率和死亡率[16]，建议参考相关指标进行风险评估，必要时可对部分指标进行干预，例如补充铁剂纠正贫血、纠正电解质紊乱等（表1）。

2.2 糖尿病的评估和管理

围术期高血糖会导致术后并发症发生率增高，椎间盘突出复发率增加[17]，神经功能改善受到影响[18]，糖尿病患者术前血糖＞6.9 mmol/L和术后血糖＞11.1 mmol/L是脊柱术后感染独立危险因素[19]。糖尿病会降低脊柱术后患者的远期疗效，围术期的血糖控制不好会影响患者的远期疗效[20]。因此建议将空腹血糖控制在5.56~10.00 mmol/L之间[21]。中国围术期血糖管理专家共识认为空腹血糖应控制在10 mmol/L以内，随机血糖应控制在12 mmol/L以内。

2.3 心、脑血管疾病的评估和管理

脊柱患者常合并有心、脑血管疾病，需长期口服抗血小板药物，对此需权衡停药导致心、脑血管意外的风险和不停药导致围术期出血的风险。抗血小板药物作为一级预防用药时，围术期停药不增加血栓性并发症风险，而作为二级预防用药时，围术期停药会导致血栓性并发症的发生风险增加1.82倍[22]；因此，建议抗血小板药物作为一级预防用药时可停药，作为二级预防用药时不停药。停用抗血小板药物需考虑它的半衰期，例如阿司匹林停药7~10 d才可减少脊柱术后引流量和引流管留置时间，所以建议术前至少停药7 d以上[23]。

2.4 营养状况的评估和管理

脊柱术后由于患者机体需要较高的基础能量，即使一些术前营养状况良好的患者，术后营养指标（血清白蛋白、血淋巴细胞总数等）仍有可能出现明显的下降，这可能会增加术后并发症的发生率、伤口的延迟愈合和住院时间的延长[24]。对于中高危患者，术前口服补充营养素和微量营养素有利于改善患者的营养状况，对分期脊柱重建患者给予全胃肠外营养（total parenteral nutrition, TPN）有利于改善患者术后的营养指标，减少并发症的发生[25]。

表1 E-PASS评分和POSSUM评分

参数	E-PASS评分	POSSUM评分
术前生理指标	年龄、是否有严重的心脏疾病、是否有严重的肺部疾病、是否有糖尿病、体能状态指数和美国麻醉师协会分级	年龄、心脏体征、呼吸系统病史、收缩压、脉搏、格拉斯哥昏迷量表评分、血色素、白细胞计数、血尿素氮、血钠、血钾和心电图
手术指标	预计失血量、体重、手术时间和切口长度	手术等级、是否二次手术、预计失血量、是否有腹腔污染、是否为恶性肿瘤、是否急诊手术

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3 抗菌药物使用与皮肤准备

手术部位感染（surgical site infection, SSI）尤其是深部组织感染，是脊柱外科手术的严重并发症之一，同时也是导致手术失败及术后脊柱内植物翻修的重要原因之一。

根据《抗菌药物临床应用指导原则（2015年版）》[26]，脊柱手术推荐切皮前0.5~1 h或麻醉开始时常规使用第一/二代头孢菌素，手术时间超过3 h或超过所使用药物半衰期2倍以上，或成人术中出血量超过1500 ml，术中应追加一次。术前单次应用抗菌药物者与术前术后多次应用抗菌药物者比较，术后感染的发生率无明显区别[27,28]。一般无需联合用药，总的预防用药时间不超过24 h。抗菌药物疗程的不当延长不仅不会降低感染的概率，反而会增加耐药菌的产生[29]。

对于皮肤准备，术前可以使用香皂沐浴以降低体表固有的菌落水平，使用碘酒进行切皮前术区消毒与使用洗必泰、碘伏相比可以明显降低术后感染的发生率[30,31]。

4 麻醉

全身麻醉患者体验好，易于接受，术后即刻可判断患者神经功能状态，并且适用于时间较长的手术，但是，也存在着返流和误吸、呼吸和心脏功能抑制、恶性高热等并发症；椎管内麻醉与全身麻醉相比，具有术后肺部并发症更少，术中可以调整姿势等优点，同时其在术后恶心呕吐、镇痛药的使用以及高血压的发生率等方面也要优于全身麻醉[32-34]，但是其存在着加重已有神经症状的风险。局部麻醉与全身麻醉相比，其操作简便、并发症少，对患者生理功能影响小，还可起到一定程度术后镇痛的作用，适用于中、小手术，但患者体验往往不如全身麻醉。

脊柱外科手术大多采用全身麻醉，传统的术前禁食水时间为6~8 h，可能会导致患者不适，同时增加胰岛素抵抗，增加蛋白质分解。目前，已有多个国家的麻醉协会已经修改为术前2 h可进食不含固体的清洁流食[35]，术前2 h饮用400 ml含12.5%碳水化合物的饮料，以减轻术前饥饿及干渴感，降低术后胰岛素抵抗，维持糖原水平，减少蛋白质分解和增加术后肌力恢复，提高患者满意率[36,37]。

5 手术技术

脊柱外科手术需要将微创、精准的操作理念贯穿于手术全程。从体位摆放开始，由于脊柱手术多采用俯卧位，且手术时间长，可导致眼压升高造成视神经缺血，同时腹部受压可以导致下腔静脉回流不畅，椎旁静脉回流增加，因此，摆放体位时需注意避免眼部受压，并使腹部悬空，减轻腹部受压，以减少术区出血[38]。术中应该规范操作，对于有椎管内操作的需常规使用双极电凝，以减少损伤和出血[39,40]；酌情使用显微镜辅助技术或佩戴头戴式手术放大镜[41-43]，以利于放大手术视野、增强术区光源以及减少神经血管损伤。对于脊柱外科手术，术中使用神经电生理监测有利于提高手术的安全性[44,45]。

6 激素应用

糖皮质激素可以抑制炎症反应、减轻脊髓和神经根水肿、改善局部血液循环，广泛应用于脊柱外科围术期。研究显示，麻醉前应用糖皮质激素可有效减少气道痉挛，喉头水肿等插管所致的并发症[46]。在椎间盘切除术中硬膜外应用激素可以减轻神经根水肿，减少术后早期的疼痛，但不能减少后期的疼痛和缩短住院时间[47-50]。尽管2013 CNS/AANS急性颈椎和脊髓损伤管理指南[51]中指出，脊髓损伤8 h内应用大剂量甲泼尼龙冲击治疗有效，但是由于急性脊髓损伤研究（national acute spinal cord injury study, NASCIS）多期临床试验研究的实验设计和统计学方法受到质疑，激素用于治疗急性脊髓损伤目前仍存在争议。对于术中及术后出现脊髓损伤的可以将其作为一种治疗选择，但是需要注意可能引起的并发症。

7 围术期血液管理

7.1 术前血液管理

术前贫血是外科术后并发症发生、死亡的独立危险因素[52,53]。尤其对于择期手术，术前需进行贫血筛查并及时治疗贫血，具体方法请参照《中国骨科手术加速康复——围术期血液管理专家共识》[54]。

7.2 自体血回输

对于术中预计出血量达到总血容量10%或＞400 ml时，建议采用自体血回输。此技术可以有效节约血源，并能避免感染经血传播疾病以及输血不良反应[55,56]。但是，由于回输过程中血浆成分丢失较多，出血量大时需注意补充血浆成分。对于脊柱感染和脊柱肿瘤等相对禁忌的患者，在使用自体血回输时可联合白细胞过滤器，初步研究[57,58]表明它是安全有效的。

7.3 控制性降压

尽管控制性降压的效果仍存在一定争议，但是相关研究[59,60]仍然肯定了控制性降压的作用。其可以减

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少术中出血，保证手术视野清晰，缩短手术时间，降低输血需求。一般来说，控制性降压需要将收缩压降至80~90 mmHg或平均动脉压降至50~65 mmHg（合并高血压的需降至原平均动脉压的70%），术中监测并根据情况及时调整[61]。对于严重脊柱畸形矫正、肿瘤切除等脊髓缺血损伤高风险手术以及急性脊髓损伤患者，不建议控制性降压，并且术中需维持平均动脉压高于80~90 mmHg[62-64]。

7.4 止血药物

氨甲环酸通过竞争性抑制纤溶酶原激活因子，使血浆中的纤溶酶原不能转变为纤溶酶，进而抑制纤维蛋白的溶解。脊柱大手术静脉使用氨甲环酸能够显著降低术中、术后出血及输血量，并且不增加DVT的发生率[65-67]。2013 ESA围术期严重出血管理指南[68]推荐在脊柱手术中应用氨甲环酸，在儿童及成人脊柱侧凸或脊柱手术使用10~20 mg/kg的氨甲环酸负荷剂量接着1 mg/（kg·h）的持续静脉滴注可有效减少失血且耐受性较好。

7.5 术后血液管理

术后应密切观察患者切口及引流管引流量，监测血红蛋白水平和红细胞压积的变化趋势，酌情进行输血治疗，术后单独口服/静脉补充铁剂和促红细胞生成素（erythropoietin, EPO）以及两者的联合使用可使患者获益，但其循证医学证据的质量均不高[69]。

8 围术期输液管理

围术期液体管理存在“自由”、“限制”、“标准”等方案争议。由于术中自由输液方法容易引起稀释性凝血功能障碍，减少组织氧供，增加出血量，导致并发症发生率和死亡率升高[70,71]，因此目前一般认为围术期限制性输液有利于患者术后康复，减少术后并发症，改善患者预后。采用每搏变异量（stroke volume variation, SVV）为目标导向的术中限制性输液可减少脊柱大手术患者术后出血及输血，肺炎、胃肠道功能紊乱的发生率，缩短ICU及住院时间[72]，在呼吸道管理方面可降低喉头水肿及再插管率[73]，均有利于促进术后康复进程。

仅输大量晶体液并不能很好的维持微循环血流灌注[74]。且它会向组织间隙渗透，加重术后的水钠潴留[75]，因此，合理应用胶体及晶胶结合的输液方案，对脊柱外科术后加速康复具有重要意义。

在全身麻醉已清醒，患者开始进食并且血压平稳时就可以停止输液治疗[76]。

9 疼痛管理

控制术后疼痛是减少患者卧床及住院时间，加速康复的重要方法。脊柱术后疼痛包括切口周围疼痛与神经根性疼痛，与其他类型手术相比疼痛程度更严重，因此需制定更加完善的围术期疼痛控制方案。

在脊柱外科应用较广泛的是围术期使用以非甾体抗炎药物为基础的镇痛方案，提倡超前及多模式镇痛[77,78]。近年来，切口内、硬膜外使用局麻镇痛药物浸润、泵入等方式越来越受到重视[79-83]。在口服药物有禁忌或困难的情况下，患者自控镇痛（patient controlled analgesia, PCA）可获得良好的镇痛效果。但对于无阿片类药物用药史的患者，阿片类药物的持续基础输注并不会提高镇痛效果，反而增加术后恶心、呕吐发生的机率[84]。通过联合应用多种药物的方法达到减少阿片类药物的用量及其不良反应的目的，可以有效的促进术后康复。

对于围术期神经根性疼痛的管理，在足量规律使用非甾体类抗炎药的基础上，加用神经修复剂、肌松剂及抗惊厥药，可提高总体疗效及患者满意度[85-87]。

10 血栓预防

脊柱手术术后深静脉血栓发生率为2.8%~12.5%不等[88,89]。截瘫、恶性肿瘤、高龄、肥胖、静脉曲张、脑梗塞、血栓病史及家族史、D二聚体增高、手术时间长、急诊手术等是脊柱手术术后深静脉血栓及肺栓塞高危因素[90-93]。

血栓预防主要包括基础预防、物理预防和药物预防三个方面[94]。研究[95-98]表明，术后肢体主动及被动活动、弹力袜及充气加压装置等物理措施可明显降低脊柱手术术后深静脉血栓发生率。

硬膜外血肿是脊柱术后一种较为严重的并发症，可以导致轻瘫[98]，因此，对于术后是否行药物预防目前仍存在争议。对截瘫及恶性肿瘤等高危患者，在无出血风险情况下应联合药物预防措施，药物预防（主要为低分子肝素）于术后24~36 h内开始应用，截瘫患者预防时间应持续到伤后3个月[99,100]。

11 术后消化道管理

女性、不吸烟、既往有术后恶心和呕吐（postoperative nausea and vomiting, PONV）病史、晕动症、术前焦虑、偏头痛、以及术后应用阿片类药物等高危患

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者，PONV 的发生率可达 70%~80%[101]。PONV 会加重患者的不适感和降低治疗的满意度，而且因延长住院时间导致增加患者住院费用；因此对高危患者应预防性使用止吐药物，并减少阿片类药物用量，以降低PONV的发生率[102,103]。

腹胀是脊柱手术术后常见并发症，腰椎后路融合术术后腹胀发生率约2.6%，前路融合发生率约7.5%，而前后联合入路约8.4%，腹胀的原因为结肠麻痹性梗阻[104]。研究[105,106]表明，咀嚼动作可作为术后腹胀的预防措施，胃肠动力药物是腹胀的主要治疗措施[107]。

12 切口引流管管理

脊柱术后留置切口引流管可以减轻术区肿胀，但也可能会导致术后血红蛋白丢失增加，增加输血的风险，且是否放置引流管对切口感染、血肿、裂开或再次手术没有明显影响[108]。目前对于脊柱后路手术是否需要放置引流管暂无高级别的证据支持[109]。脑脊液漏是脊柱外科手术最常见的、有时是不可避免的并发症之一，通过术后放置引流管可有效处理脊柱术后脑脊液漏，但是对于早期还是延迟拔除引流管尚无定论[110,111]。

13 尿管管理

术后留置尿管可以缓解脊柱术后尿潴留，促进膀胱功能恢复，但是术后尿管留置时间过长明显增加尿路感染的发生率，也不利于患者早期功能锻炼，降低了患者的满意度，延长住院时间，所以应该尽早拔管[112]。对男性、高龄、麻醉时间超过200 min等尿潴留高危患者，可适当延长拔管时间[113,114]。对于脊髓损伤并导致排尿功能障碍的患者，当血流动力学稳定、出入量平衡时，可停止留置导尿，尽早进行间歇导尿[115]。

14 术后康复锻炼

术后早期进行功能锻炼有利于减轻术后疼痛，促进功能恢复，减少并发症，缩短住院时间，提高患者的满意度。在遵循“提高患者自信”、“尽早离床”、“安全而不加重疼痛”、“主动运动为主被动为辅”、“适应性起步逐渐增量”的原则下，制定相对个体化的康复锻炼方案，其具体项目主要包含：术后早期适应性训练（如足趾屈伸、踝泵运动、直抬腿等）、脊柱稳定性训练（腹横肌、多裂肌锻炼）、心血管功能训练（吹气球）、步行训练、脊柱交界区（颈胸段、胸腰段）和邻近肢体关节的牵拉训练[116-119]。

15 出院后管理

术后定期随访监测有利于了解患者的恢复情况并及时处理并发症。脊柱外科的随访除常规功能指数及疼痛评价外，应注意指导患者正确使用康复器具，服用止痛药物及进行正确的康复锻炼。

附《脊柱外科加速康复—围术期管理策略专家共识》骨科专家组成员（按拼音排序）：

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