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· 临床指南 ·

中国骨科手术围手术期贫血诊疗指南

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【摘要】贫血是骨科患者围手术期常见的并存疾病，发生率为12.8%~45.0%。术前贫血常见原因有营养不良、慢性失血性疾病、肿瘤、自身免疫性疾病、慢性感染或创伤等；手术导致的显性和隐性失血术后又将加重贫血。术后贫血造成细胞、组织、器官缺血缺氧，增加输血率、感染风险、致残率及死亡率，易引发血液传播疾病并影响免疫功能，延缓术后康复，延长住院时间。术前明确贫血病因及贫血类型是治疗贫血的关键。骨科手术围手术期常见贫血类型有缺铁性贫血、正细胞正血色素贫血、大细胞型贫血等。平均红细胞体积（MCV）、平均红细胞血红蛋白量（MCH）、平均红细胞血红蛋白浓度（MCHC）、血清铁（SI）水平、血清铁蛋白（SF）水平、总铁结合力（TIBC）等检测可明确贫血类型。贫血治疗包括术前积极处理原发病、消除病因、加强营养、提高血红蛋白水平，术中微创操作、控制性降压、应用氨甲环酸减少出血、减少手术失血的应激反应，围手术期铁剂联合应用促红细胞生成素（EPO）加快提升血红蛋白水平及减少术后异体输血等，必要时联合血液科医师共同诊治，促进患者早期康复，降低或避免并发症发生。

【关键词】骨科手术；贫血；围手术期；诊断；治疗

Guidelines for diagnosis and treatment of anemia during perioperative period of orthopedic surgery in China

Committee of Musculoskeletal Rehabilitation technology Transformation of China Association of Rehabilitation Technology Transformation and Promotion
Joint Diseases Prevention and Treatment Branch of China International Exchange and Promotion Association for Medical and Healthcare
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【Abstract】 Anemia is a common comorbid disease in orthopedic patients, with an incidence ranging from 12.8% to 45.0%. The common causes of preoperative anemia contain malnutrition, chronic blood loss, cancer, autoimmune disease, chronic infection and trauma. If preoperative anemia cannot be corrected, the condition would aggravate in addition to the surgical trauma, dominant and hidden blood loss caused by the surgery. Postoperative anemia would lead to ischemia and hypoxia of cells, tissues and organs, which increase transfusion rate, infection risk, morbidity and mortality, easily cause blood-borne diseases, affect immune function, delay postoperative recovery and prolong hospital stay. The key point of anemia treatment is to find out the cause and type of anemia before operation. Common types of anemia during the perioperative period of orthopedic surgery include iron deficiency anemia, positive cell hemoglobin anemia, and large cell anemia. Mean red blood cell volume (MCV), mean red blood cell hemoglobin (MCH), mean red blood cell hemoglobin concentration (MCHC), serum iron (SI), serum ferritin (SF), total iron binding capacity (TIBC) were used to determine the anemia type. Based on the diagnosis and anemia type, surgeons can take measures such as actively treating the primary disease, eliminating the cause, reinforcing nutrition, and improving hemoglobin level before surgery, performing minimally invasive operation, controlled hypotension, tranexamic acid application, autologous blood absorption, and reducing stress reaction caused by blood loss during surgery, perioperative iron and erythropoietin, and allogeneic blood transfusion. If necessary, MDT was given to correct anemia. By doing these, we can promote early recovery, reduce or avoid the occurrence of complications.

【Key words】 Orthopaedic Surgery, Anemia , Preoperative Management, Diagnosis, Treatment

骨科患者围手术期贫血十分常见，常因合并老年营养不良、慢性失血性疾病、肿瘤、自身免疫性疾病、创伤等多种疾病导致术前存在不同程度的贫血。如术前不能及时纠正患者的贫血状态，手术本身又会造成显性和隐性失血，则术后贫血将加重。术后贫血造成细胞、组织、器官缺血缺氧，增加输血率、感染风险、致残率及死亡率，易引发血液传播疾病并影响免疫功能，延缓术后康复，延长住院时间[1,2]。因此，骨科手术患者围手术期贫血的诊断与治疗尤为重要。

为进一步提高、规范和推广骨科手术围手术期贫血的诊断与治疗，国家卫生健康委员会公益性行业科研专项《关节置换术安全性与效果评价》项目组联合中国康复技术转化及发展促进会肌肉骨骼运动康复技术转化专业委员会、中国医疗保健国际交流促进会骨科分会关节学组、中国研究型医院学会，共同邀请骨科、血液科、麻醉科、输血科专家参与，复习国内外文献，遵循循证医学原则，编辑整理完成本指南，供广大骨科医师在临床工作中根据医院条件和患者情况参考应用。

1 概述

1.1 骨科围手术期贫血的发生率

骨科手术患者围手术期贫血十分常见。国外研究显示骨科手术患者术前贫血发生率分别为：髋、膝关节置换术12.8%~24.3%[3,4]，脊柱择期手术21%~24%[3,5]，创伤骨科手术42%~45%[4,6,7]。髋部骨折患者术前血红蛋白(hemoglobin, Hb)水平下降可超过20 g/L[8]，骨肿瘤患者因术前放化疗Hb水平约为100 g/L[9]。项目组数据库20308例资料显示术前贫血发生率：髋关节置换术男性为25.6%，女性为32.8%；膝关节置换术男性为30.2%，女性为25.3%；股骨头置换术男性为49.4%，女性为41.3%。提示中国骨科手术患者术前贫血发生率高于国外。

国外研究显示髋、膝关节置换术后贫血发生率达80%以上[4]；脊柱手术后贫血率，男性为82.7%，女性为85.8%[3,5]。髋部骨折手术后贫血率为84.6%~88.5%[6]。骨肿瘤手术后贫血率达89.2%[10]。项目组数据库资料显示术后贫血发生率：髋关节置换术男性为86.2%，女性为89.8%；膝关节置换术男性为82.5%，女性为84.3%；股骨头置换术男性为88.6%，女性为78.6%。

1.2 骨科手术围手术期贫血的危害

骨科手术围手术期贫血的危害主要表现在以下方面：①增加术后感染率：研究表明，全髋关节置换术(total hip arthroplasty, THA)和全膝关节置换术(total knee arthroplasty, TKA)术前Hb≤100 g/L的患者术后手术部位感染率是Hb≥120 g/L的患者的5倍，达4.23%[11]；②延长住院时间：无论是术前还是术后贫血的患者，其住院时间均会延长[4,12,13]；③增加术后死亡率：术前贫血和术后贫血均显著增加术后死亡率[1,4]；④延迟患者术后功能恢复：骨科手术后Hb水平较高的患者功能恢复更好[14]，贫血是影响术后功能活动和正常行走的独立危险因素[13]；⑤影响患者术后生活质量：出院时患者的Hb水平与术后2个月生活质量评分呈正相关[15]。

1.3 骨科手术围手术期贫血的原因

1.3.1 术前贫血的原因：①骨科创伤失血量大：四肢长骨骨折出血量即可多达1000 ml以上[16-18]，骨盆骨折

出血量可达5000 ml[19-21]，如为开放性损伤出血更多[22]。近50%的创伤骨科患者入院时即贫血，甚至重度贫血或需要输血才能挽救生命；②老年营养不良：骨科择期手术中的老年患者占比较大，这类患者有些在中年时因预防高血脂、高血压、高血糖而节饮节食，或偏食，摄入不足，长期营养缺乏，这类患者术前缺铁性贫血发病率可达25%左右[23]；③合并慢性出血性疾病：患者术前常合并有慢性出血性疾病，如慢性胃肠道出血（如胃十二指肠溃疡、肠息肉、痔疮、消化道肿瘤等）、月经过多、血尿等所致的慢性失血极易引起术前贫血[23]；④感染性骨关节疾病：骨骼、关节的感染性疾病属于慢性消耗性疾病，也是术前贫血的重要原因之一[24]；⑤自身免疫性疾病：类风湿性关节炎、强直性脊柱炎等自身免疫性疾病患者术前常合并缺铁性贫血，可能原因是炎性疾病本身造成贫血或治疗过程中长期服用非甾体抗炎药（nonsteroidal antiinflammatory drugs, NSAIDs）导致的消化道慢性出血以及长期应用免疫抑制剂造成骨髓造血抑制导致的贫血[25, 26]；⑥肿瘤相关性贫血：骨的原发或继发恶性肿瘤或合并其他系统的肿瘤均可造成慢性贫血，其机制与肿瘤发生时产生的肿瘤坏死因子α（tumor necrosis factor-α, TNF-α）、白细胞介素1（interleukin-1, IL-1）等因子有关，不仅抑制促红细胞生成素（erythropoietin, EPO）的产生，而且还使骨髓造血干细胞对EPO反应性减弱或代偿不足。肿瘤发生时机体还会出现保护性甲状腺功能低下，T3向T4转化率降低，进一步抑制EPO的产生[27]。另外，机体产生的急性免疫反应即宿主防御反应还会导致铁代谢障碍[28]。

1.3.2 术中、术后贫血的原因：①手术创伤失血：骨科手术涉及骨和肌肉等血供丰富的组织，手术所致的失血量较大。国内外研究表明，初次单髋、膝关节置换术创伤造成的总失血量约1000 ml[29-36]，翻修手术所致的失血量为1500~2000 ml[37-42]；髋部骨折术中术后的失血量为1200~1600 ml[43-46]；国外文献报道脊柱后路手术最大失血量可达1500 ml左右[47]。骨科围手术期失血大部分都是隐性失血，可为显性失血的3~6倍[48-50]。另外，骨肿瘤手术，尤其是脊柱和骨盆肿瘤切除术的术中失血量可达10000 ml以上，极易导致失血性休克[27]。②术后营养不良：由于手术创伤、炎症反应、疼痛刺激、药物不良反应等影响，患者术后常出现精神不振、食欲不佳、摄入不足，不利于术后贫血的纠正；而贫血、低蛋白血症本身也会引起和加重胃肠道黏膜水肿、恶心、头昏、精神不振、厌食等问题，从而进一步加重贫血和低蛋白血症，导致恶性循环[51, 52]。

因此，骨科手术患者术前即可能存在贫血或处于贫血临界状态，在此状态下接受骨科手术，术中、术后所致失血以及术后恢复不佳势必进一步加重贫血。

2 骨科手术围手术期贫血的诊断

临床常用的贫血诊断标准有WHO标准[53]和中国标准[54]，结合骨科手术围手术期失血量大、贫血发病率高、输血率高的特点，为便于国际交流，推荐采用WHO贫血诊断标准，即Hb男性<130 g/L，女性<120 g/L或红细胞压积（hematocrit, Hct）男性<39%，女性<36%即诊断贫血。

为便于骨科医师快速高效的诊断和处理贫血，推荐运用红细胞形态学方法来区分贫血，即根据患者的平均红细胞体积（mean cell volume, MCV）、平均红细胞血红蛋白量（mean corpuscular hemoglobin, MCH）及平均红细胞血红蛋白浓度（mean corpusular hemoglobin concentration, MCHC）将贫血分为3个类型[54]。

2.1 小细胞低色素性贫血

MCV<80 fl、MCH<27 pg、MCHC<320 g/L为小细胞低色素性贫血。主要见于缺铁性贫血（iron deficiency anemia, IDA）、铁幼粒细胞性贫血、珠蛋白生成障碍性贫血及慢性疾病性贫血。其中以IDA最为常见，也是骨科围手术期最常见的贫血类型。

有条件的医院可以进一步检查铁代谢、反应铁代谢的指标，如血清铁（serumiron, SI）、血清铁蛋白（serum ferritin, SF）、总铁结合力（total iron binding capacity, TIBC）。SI水平降低，SF水平正常或升高，TIBC正常或降低，诊断考虑慢性疾病性贫血（炎症、肿瘤、感染等）。SI水平降低，SF低于正常水平，TIBC显著升高，临床可诊断IDA。SI水平正常以及升高，SF水平正常或升高，诊断考虑珠蛋白生成障碍性贫血及铁粒幼细胞性贫血。

2.2 正细胞正色素性贫血

MCV正常（80~100 fl）、MCH正常（27~34 pg），MCHC正常（320~360 g/L），Hb水平、红细胞数量平衡下降，为正细胞正色素性贫血。主要见于再生障碍性贫血、快速大量失血（包括创伤后或手术后失血性贫血）、某些溶血性贫血及肾性贫血等。此型贫血的诊断和治疗最为复杂，小细胞低色素性贫血及大细胞性贫血的早期均可表现为正细胞正色素性贫血。建议骨科手术围手术期重点排查两类可快速得到治疗的贫血——肾性贫血和自身免疫性溶血性贫血（autoimmune hemolytic anemia, AIHA）。其他类型的正细胞正色素性贫血可邀请多学科团队（multidisciplinary team, MDT）会诊并治疗。

2.2.1 肾性贫血：是指由各类肾脏疾病造成EPO相对或

绝对不足，以及尿毒症患者血浆中的毒性物质通过干扰红细胞生成和代谢而导致的贫血。其诊断需满足：①患有慢性肾病，并已有肾功能损害；②Hb水平达到贫血诊断标准；③排除慢性肾病以外的因素所致的贫血[55]。

2.2.2 AIHA：是由于机体免疫功能紊乱、产生自身抗体，导致红细胞破坏加速超过骨髓代偿时发生的贫血。诊断标准为：①Hb水平达到贫血诊断标准；②检测到红细胞自身抗体；③至少符合以下1条：网织红细胞计数>0.04或绝对值>120×10^9/L；结合珠蛋白<100 mg/L；总胆红素≥17.1 μmol/L（以非结合胆红素水平升高为主）[56]。

2.3 大细胞性贫血

MCV>100 fL，MCH>34 pg，MCHC正常（320~360 g/L），大多为正色素性贫血。临床上可将此类贫血患者划分为3种情况：①伴网织红细胞大量增加的贫血（溶血性贫血、失血性贫血恢复期、营养性贫血治疗后的恢复期、化疗后骨髓造血恢复期）；②营养性巨幼细胞性贫血[叶酸和（或）维生素B_{12}缺乏状态]；③其他原因相关的大细胞性贫血：骨髓增生异常综合征、肝脏疾病、酒精成瘾、药物使用后，如羟基脲、甲状腺机能减退症等。骨科手术围手术期可重点快速排查①+②两类贫血。其他原因相关的大细胞性贫血可邀请MDT团队协作进一步诊断及治疗。

2.3.1 伴网织红细胞大量增加的贫血：可通过了解病史及筛查血常规网织红细胞计数明确诊断。

2.3.2 营养性巨幼细胞性贫血：了解饮食情况不佳，检测血清叶酸及维生素B_{12}水平下降，并伴有高乳酸脱氢酶血症者可明确诊断。

2.4 地中海贫血

地中海贫血又称海洋性贫血，是珠蛋白生成障碍性贫血，是一组遗传性溶血性贫血疾病。根据所缺乏的珠蛋白链种类及缺乏程度予以命名和分类。地中海贫血分为α型、β型、δβ型和δ型4种，其中以β和α地中海贫血较为常见。这类患者常有贫血相关家族史，既往有贫血病史，患者可能存在眼间距增宽、贫血伴肝脾肿大，血常规见小细胞低色素性贫血，红细胞大小不等，中央浅染区扩大。临床医师可根据患者的贫血相关临床特点和实验室检查，结合阳性家族史作出诊断，并请血液科医师会诊进行诊治。

2.5 多发性骨髓瘤（multiple myeloma, MM）性贫血

MM是一种恶性浆细胞病，常伴有多发性溶骨性损害、高钙血症、贫血、肾脏损害。老年贫血患者，特别是病理性骨折或发现溶骨性病变等合并贫血患者应排除或明确MM诊断，必要时需进行骨髓穿刺并请血液科医师会诊进行诊治。

3 骨科手术围手术期贫血的治疗

3.1 术前贫血的治疗

3.1.1 明确病因，积极治疗：①积极治疗慢性出血性疾病，如消化道溃疡出血、肠息肉出血、痔疮出血、创伤出血等；②停用或替换可能导致消化道慢性出血的药物，如对有消化道溃疡、出血、糜烂性胃炎的患者，术前停用非选择性NSAIDs或换用环氧化酶2（cyclooxygenase-2, COX-2）选择性抑制剂，并可同时加用质子泵抑制剂和胃黏膜保护剂；③月经量过多造成的贫血请妇科医师会诊，同时治疗贫血；④积极处理治疗原发病，如慢性感染、免疫系统异常对骨髓造血功能的抑制、控制恶性肿瘤等。

3.1.2 营养支持、均衡膳食[57]：术前营养支持应根据患者平时的饮食特点和自身情况进行安排，至少需要摄入：热量30~35 kcal/(kg·d)，蛋白质1.0~1.5 g/(kg·d)。食欲差者可给予蛋白粉等营养制剂，必要时给予胃肠动力药、胃蛋白酶等促进消化，增加营养要素摄入。

3.1.3 IDA的治疗：补充铁剂是IDA的主要治疗手段。IDA是骨科手术患者围手术期贫血的最常见病因，在明确引起IDA原因并进行相应治疗的基础上，补充铁剂可以从根本上纠正贫血，如消化性溃疡失血，子宫肌瘤导致月经过多。在骨科手术围手术期的治疗策略中，可尽早启动铁剂补充治疗，通常有较好的临床反应，可使Hb在短期内快速恢复[58, 59]。术前诊断为IDA的患者，恰当补充铁剂可以提高患者的手术耐受性，降低输血率[60]；创伤急性失血导致的贫血患者，补充铁剂可以加快提升Hb水平，纠正贫血，有助于患者的术后恢复，缩短住院时间[61, 62]。

术前可计算体内总缺铁量进行针对性的补铁，总补铁量可在计算缺铁量基础上增加500 mg，以避免补铁过多出现铁超载。所需补铁量（mg）=体重（kg）×（Hb目标值−Hb实际值）（g/L）×0.33[63]。铁剂的选择、用法用量及疗程推荐：①口服铁剂治疗：轻度贫血及心肺功能代偿好的患者可选择口服铁剂，多糖铁复合物300 mg每天1次口服或硫酸亚铁300 mg每天3次口服（或根据药品说明书使用），治疗7~10 d后，患者外周血网织红细胞可显著增加，2周后Hb水平开始升高，1~2个月后Hb水平可恢复正常，之后维持治疗至少2个月；②静脉铁剂治疗，通常采用蔗糖铁100~200 mg/d静脉滴注。根据前述公式计算所需补铁量，给予蔗糖铁100~200 mg/d静脉滴注，或3 mg/kg每周2~3次（或根据药品说明书使用），直至补足缺铁量，可联用EPO[13]。静脉补充铁剂适用于：口服铁

剂治疗未达正常的IDA患者[64]，不耐受口服铁剂、胃肠吸收障碍者[65]，中重度贫血患者[66]，严重铁缺乏者[63]，及术前需快速改善贫血的患者[64]；③铁剂应用的注意事项：参见药物使用说明书，必要时联系临床药师共同讨论制定方案。

3.1.4 EPO：meta分析和临床研究显示，单用EPO或EPO联合铁剂均可安全、有效的改善骨科手术患者的围手术期贫血状况，降低输血率[67-69]，术前3~4周应用EPO，可产生相当于5 IU红细胞的血量，且其促红细胞生成作用不受年龄、性别影响[70, 71]。

EPO的用法用量及疗程推荐：静脉注射，初始用量每次50~100 U/kg，于1~2 min注射完，每周3次；根据Hb水平提高情况决定用量，最大不超过300 U/kg，每周3次。也可每次40000 U每周1次，或600 U/kg每周1次，或300 U/kg每周2次。EPO持续时间3~4周，4周者多见[72, 73]。或参照EPO应用药品说明书执行。

3.1.5 巨幼细胞性贫血的治疗：建议在营养支持的基础上同时应用叶酸与维生素B_{12}[65]，具体用法：①叶酸，每次5 mg口服，每日1~3次，口服不耐受者改用甲酰四氢叶酸钙，每次3 mg肌内注射，每日1次；②维生素B_{12}，每次0.5 mg口服，每日1次，口服不耐受者改为0.5 mg肌内或静脉注射，每周3次，直至贫血纠正，或咨询血液科医师决定是否继续服用。

3.1.6 肾性贫血的治疗：首先治疗慢性肾病，必要时血液透析纠正肾功失代偿状态，同时联合使用铁剂和EPO治疗，推荐使用静脉铁剂[55]。

3.1.7 AIHA的治疗[56]：①积极寻找病因，治疗原发病；②首选糖皮质激素治疗，常用泼尼松1.0~1.5 mg/(kg·d)；②对糖皮质激素耐药或维持剂量超过泼尼松15 mg/d或不能耐受糖皮质激素者，以及AIHA复发和难治性/重型AIHA者可选择二线治疗方案，包括脾切除、免疫制剂、利妥昔单抗及其他治疗方案(免疫球蛋白对部分AIHA患者有效)。血浆置换对IgM型冷抗体效果较好。

3.1.8 伴网织红细胞大量增加的贫血的治疗：此类患者处于贫血恢复期，应保障营养要素和造血原料的摄入，在营养充足的基础上给予叶酸5 mg口服，每日1~3次，维生素B_{12} 0.5 mg口服，每日1次或0.5 mg肌内注射，每周3次，同时补充铁剂，具体方法同前述。

3.2 术中减少出血的措施

骨科手术术中出血量较大，如何减少术中失血、有效止血，是控制术后贫血的关键。

3.2.1 贫血患者手术时机的选择：术前贫血患者经综合治疗，贫血得到纠正或改善后可进行手术。建议择期手术在无活动性、隐性出血，Hb≥100 g/L时进行。

3.2.2 微创理念优化手术操作：微创的核心是组织损伤小、出血少、生理机能影响小，采用传统入路的骨科手术均应采用微创操作，并贯穿于手术全过程，保护肌肉和软组织，减少组织损伤，尽可能减少出血。对于可能会累及大血管或出血量较大的手术，如骨盆骨折、骨盆肿瘤等，可在术前采用高选择性血管介入栓塞等措施降低术中出血。

3.2.3 术中控制性降压：控制性降压是指利用麻醉药物和技术使动脉血压降低并控制在一定水平，以利于手术操作、减少术中出血及改善血流动力学的方法，将平均动脉压降低至60~70 mmHg，或将动脉收缩压控制在其基础值70%以上，以达到减少失血的目的[73]，且不会导致心脏、肾脏等重要脏器的缺血缺氧性损害[74]。但以下情况禁用：①严重心脑血管疾病、未控制的高血压、糖尿病晚期、肾功能不全等器质性疾病；②存在氧供耗失衡情况，如肺通气和换气障碍等；③有血管栓塞或血栓病史等[75]。

3.2.4 抗纤溶药的应用：研究表明骨科手术围手术期总失血量中隐性失血占到70%以上，其主要原因在于手术创伤及止血带应用导致的纤溶亢进[13]。目前临床上最常用的抗纤溶药是氨甲环酸，是一种人工合成的赖氨酸衍生物，可竞争性结合纤溶酶原的赖氨酸结合位点，抑制纤溶酶原激活，从而发挥抗纤溶作用。氨甲环酸在骨科手术中的应用，可参考《中国骨科手术加速康复围手术期氨甲环酸与抗凝血药应用的专家共识》[76]。

3.2.5 术中自体血回输：多项随机对照临床研究和meta分析证实，术中自体血液回输可安全有效地降低骨科手术围手术期异体输血需求[9, 79, 80]。适应证包括：①预期出血量＞400 ml或＞10%血容量；②患者Hb水平较低或有高出血风险；③患者体内存在多种抗体或为稀有血型；④患者拒绝接受同种异体输血等[77, 78]。禁忌证包括：①回收的血液中含有促凝剂、碘伏、双氧水等的冲洗液，或含有亚甲蓝等难以洗出的物质；②回收的血液被细菌、粪便、羊水或毒液等污染；③恶性肿瘤患者；④回收的血液严重溶血；⑤血液系统疾病，如镰状细胞性贫血、珠蛋白生成障碍性贫血等；⑥其他原因，包括一氧化碳中毒、血中儿茶酚胺水平过高(嗜铬细胞瘤)等[79-81]。

3.3 术后贫血的预防与治疗

手术创伤造成的显性和隐性失血，易造成或加重术后贫血。

3.3.1 减少术后出血：骨科切口部位适当加压包扎、冰敷，以减少创面出血。术后密切观察伤口有无渗血、引流管引流量和切口周围肢体肿胀程度，在术后使用

抗凝剂的情况下还需警惕全身其他部位有无出血。

3.3.2 营养支持：对于术后贫血患者，应同术前一样持续进行营养支持，根据患者饮食习惯和喜好保证充足的热量和蛋白摄入，必要时请营养科配置营养要素饮食；对于食欲欠佳患者给予促胃肠动力药[57]。

3.3.3 应用铁剂和EPO：术前诊断为IDA、肾性贫血而术后仍有贫血者应序贯使用铁剂联合EPO治疗；因术中、术后失血导致术后贫血者也应在营养支持基础上使用铁剂联合EPO治疗。术后贫血患者住院期间可选择静脉铁剂，经治疗Hb水平达100 g/L以上者可出院后继续口服铁剂或联合EPO皮下注射，具体方法同术前贫血治疗[81]。

3.3.4 异体输血：异体输血的优点是可以迅速提升Hb水平，适用于急救患者和采用其他方式治疗无效的贫血患者。但异体输血存在病毒感染、免疫过敏反应、急性溶血反应、输血相关急性肺损伤等风险，同时我国还面临着血资源紧张的现实问题。因此，围手术期血液管理建议采用限制性输血策略，严格输血指征[70, 82]。Carson等[83]对31项随机对照研究结果进行系统评价提示，限制性输血策略（Hb水平为70~90 g/L）较非限制性输血策略可降低39%~43%的输血率，且不会增加术后30 d内的死亡率、并发症发生率和再入院率，也不会影响患者术后康复。因此，建议采用2000年我国卫生部颁发的《临床输血技术规范》中的规定：Hb＞100 g/L一般不必输血；Hb＜70 g/L需要输血；Hb为70~100 g/L应根据患者的年龄、贫血程度、心肺功能情况、有无代谢率增高决定是否输血，如果术后患者存在心悸、疲乏无力、呼吸急促，或术前患者并存冠状动脉粥样硬化性心脏病、肺心病等病史，建议输血。

本指南仅适用于骨科医师对骨科手术围手术期贫血进行快速有效的诊断和治疗，对于原因不明性贫血或难纠正的贫血患者应请血液科和相应基础疾病专科医师会诊。应用EPO或铁剂时应参照药物说明书，如遇不良反应时应立即停药并处理，不良反应严重时应请相关科室医师会诊。

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