

# 中国手术部位感染预防指南

中华医学会外科学分会外科感染与重症医学学组 中国医师协会外科医师分会  
肠瘘外科医师专业委员会

通信作者:任建安, Email:jiananr@nju.edu.cn, 电话:025-80860108



扫码阅读电子版

**【摘要】** 手术部位感染(SSI)是最常见的卫生保健相关感染之一,易增加患者的经济负担,延长住院天数,甚至危及患者的生命安全。预防SSI需要在术前、术中和术后共同采取一系列措施。鉴于此,本指南编写委员会的专家基于现有的医学研究结果,结合我国的临床实践,经过反复多次讨论,综合考虑了干预措施的利弊、证据质量、费用和资源占用、价值观和偏好等,从术前和术中术后两大阶段探讨适合中国国情的SSI防控策略,最终针对术前预防措施(包括营养支持、免疫抑制剂、术前沐浴、机械性肠道准备与口服抗生素、去除毛发、外科手术预防性抗生素的最佳时机、外科手消毒)和术中术后预防措施(包括维持体温、围手术期血糖控制、液体治疗、手术铺巾和手术衣、贴膜、切口保护套、切口冲洗、预防性伤口负压治疗、抗菌涂层缝线、引流放置时的预防性抗生素与引流移除的时机、切口敷料、延长预防性抗生素使用时间)形成了22条推荐意见。需注意的是,临床医生在应用推荐意见时,应结合所在医院的条件,根据患者的具体情况而定。SSI预防措施中仍有诸多问题尚未解决,需要在未来进行更多的研究。

**【关键词】** 手术部位感染; 抗生素; 预防; 控制

**基金项目:**江苏省重点研发项目(BE2016752);军事医学创新工程(16CXZ007)

DOI:10.3760/cma.j.issn.1671-0274.2019.04.001

## Chinese guideline for the prevention of surgical site infection

Chinese Society of Surgical Infection and Intensive Care, Chinese Society of Surgery, Chinese Medical Association, Chinese College of Gastrointestinal Fistula Surgeons, Chinese College of Surgeons, Chinese Medical Doctor Association

Corresponding author: Ren Jianan, Email:jiananr@nju.edu.cn, Tel: 025-80860108

**【Abstract】** Surgical site infection (SSI) is one of the most common health care-associated infections, which increases patients' financial burden, prolongs hospital days, and even raises mortality. Prevention of SSI requires the integration of a range of preventive measures before, during, and after surgery. This guideline is based on current evidence and clinical practice, and takes into account the balance between benefits

and harms, the evidence quality level, cost and resource allocation, and patient values and preferences. We present in this guideline 22 recommendations suitable for Chinese conditions and specific to the preoperative, intraoperative and postoperative periods. Preventive measures including nutritional support, immunosuppressive agents, bathing, mechanical bowel preparation with oral antibiotics, hair removal, optimal timing for administration of surgical antibiotic prophylaxis, and surgical hand preparation, were involved in the preoperative period. During the intraoperative and postoperative period, preventive measures include normothermia, blood glucose control, fluid therapy, drapes and gowns, wound-protector devices, incisional wound irrigations, prophylactic vacuum suction therapy, antimicrobial-coated sutures, antimicrobial prophylaxis in the presence of a drainage, optimal timing for wound drain removal, wound dressing, and surgical antibiotic prophylaxis prolongation. It should be noted that when applying recommendations, surgeons should combine the conditions of their hospitals and patients' conditions. More researches are required to further investigate unsolved problems.

**【Key words】** Surgical site infection; Antibiotics; Prevention; Control

**Fund program:** Key Project of Jiangsu Social Development (BE2016752); Innovation Project of Military Medicine (16CXZ007)

DOI:10.3760/cma.j.issn.1671-0274.2019.04.001

手术部位感染(surgical site infection, SSI)是指发生在手术切口、深部器官和腔隙的感染,是中低收入国家最多见、最高发的卫生保健相关感染(health care-associated infection, HAI),总体发生率达11.8%(1.2%~23.6%);而在高收入国家,SSI发生率在1.2%~5.2%之间<sup>[1-2]</sup>。虽然SSI的发生率在高收入国家明显降低,但依然是第二常见的HAI。

术前、术中和术后一系列措施均可降低SSI风险。现有影响力较大的SSI预防指南均来自欧美发达国家的研究机构,如1999年美国疾病控制预防中心(Center for Disease Control and Prevention, CDC)发布SSI预防指南<sup>[3]</sup>,其在2017年

进行了更新<sup>[4]</sup>。2008 年,英国国家卫生与临床优化研究所(National Institute for Health and Clinical Excellence, NICE)发布了 SSI 预防与治疗的指南<sup>[5]</sup>。2014 年,美国医疗保健流行病学学会(Society for Healthcare Epidemiology of America, SHEA)更新了 2008 年其发布的指南<sup>[6]</sup>。2016 年,世界卫生组织(World Health Organization, WHO)发布了预防 SSI 的全球指南<sup>[7]</sup>。我国卫生健康委员会也在 2010 年发布了《外科手术部位感染预防与控制技术指南(试行)》<sup>[8]</sup>。虽然目前 SSI 预防指南或规范众多,但是不同指南预防 SSI 的措施尚未达成共识。为此,中华医学会外科学分会外科感染与重症医学学组、中国医师协会外科医师分会肠瘘外科医师专业委员会组织国内部分专家,经过反复多次讨论和修改,结合中国临床实践,制定了《中国手术部位感染预防指南》,探索适合我国国情的 SSI 防控策略,供同道参考。

### 一、循证医学证据质量等级

在总结国内外研究进展及专家经验的基础上,按照循证医学的原则进行深入的论证,最终形成本指南,旨在为 SSI 的预防提供参考。指南主要依据循证医学证据质量等级和 GRADE 系统的推荐强度等级,见表 1。

表 1 循证医学证据质量等级和推荐强度<sup>[9]</sup>

质量等级和推荐强度	说明
质量等级	
高	对真实效应值接近效应估计值很有信心
中	对效应估计值有中等程度的信心:真实值有可能接近估计值,但仍存在二者大不相同的可能性
低	对效应估计值的确信程度有限:真实值可能与估计值大不相同
极低	对效应估计值几乎没有信心:真实值很可能与估计值大不相同
推荐强度	
强烈推荐	支持或反对某项干预措施的强烈推荐,且利大于弊
条件推荐	支持或反对某项干预措施的条件推荐,利弊不确定

## 二、SSI 的预防措施

### (一)术前预防措施

**1. 营养支持:推荐意见 1:建议接受大手术的低体质量患者口服或鼻饲富含多种营养素配方的营养液以预防 SSI(条件推荐,极低质量证据)。**

证据小结:营养不良可影响免疫状态,增加患者对感染的易感性。早期营养支持可改善营养不良或严重创伤的手术患者的预后,减少感染性并发症的发生。关于营养支持的系统评价共纳入 10 项研究[含 8 项随机对照临床试验(randomized controlled trial, RCT)<sup>[10-17]</sup>和 2 项观察性研究(observational study, OBS)<sup>[18-19]</sup>],研究对比了多种营养素配方

的营养液(精氨酸、谷氨酰胺、鱼油、核苷酸等)与标准营养液对 SSI 的影响,多种配方的营养液较标准营养液显著降低 SSI 发生风险(RCT:  $OR=0.53$ ,  $95\%CI: 0.30\sim 0.91$ ; OBS:  $OR=0.07$ ,  $95\%CI: 0.01\sim 0.53$ ),证据质量为极低。而单一营养素配方的营养液(精氨酸、甘氨酸或支链氨基酸)和标准配方营养液相比,对 SSI 发生率无影响(RCT:  $OR=0.61$ ,  $95\%CI: 0.13\sim 2.79$ <sup>[17,20-23]</sup>; OBS:  $OR=0.29$ ,  $95\%CI: 0.06\sim 1.39$ <sup>[24]</sup>),证据质量为低。因此,术前给予患者富含多种营养素配方的营养液可降低 SSI 发生的风险。

**2. 免疫抑制剂:推荐意见 2:建议不以预防 SSI 为目的在术前停用免疫抑制剂(条件推荐,极低质量证据)。**

证据小结:免疫抑制剂通常用于预防移植器官的排斥反应或治疗炎症性疾病,可能会导致愈合延迟和感染的风险增加。而停药则可能导致疾病复发,抗药抗体生成,从而减弱药物的疗效。综合 8 项临床研究的系统评价表明,与围手术期继续服用氨甲喋呤相比,围手术期停用氨甲喋呤可能会对患者造成伤害且不影响 SSI 的发生(RCT:  $OR=7.75$ ,  $95\%CI: 1.66\sim 36.24$ <sup>[25-26]</sup>; OBS:  $OR=0.37$ ,  $95\%CI: 0.07\sim 1.89$ <sup>[27-32]</sup>),证据质量为极低。另外的研究显示,围手术期停用肿瘤坏死因子(TNF)抑制剂可能有助于降低 SSI 发生率( $OR=0.59$ ,  $95\%CI: 0.37\sim 0.95$ )<sup>[27,31]</sup>。但基于目前较少证据支持停用 TNF 抑制剂以及停用氨甲喋呤可能导致的潜在伤害,指南编审专家组不建议以预防 SSI 为目标而在术前停用免疫抑制剂。

**3. 术前沐浴:推荐意见 3:在手术日前一晚(或更早时候),患者应该使用抗菌/非抗菌肥皂或其他抗菌剂进行淋浴或全身沐浴(条件推荐,中等质量证据)。**

证据小结:患者术前沐浴或淋浴为临床规范。涵盖 17 087 例外科患者的 9 项研究比较了术前沐浴使用抗菌肥皂和普通肥皂降低 SSI 的疗效,与普通肥皂相比,使用抗菌肥皂不能显著降低 SSI 的发生率( $OR=0.92$ ,  $95\%CI: 0.80\sim 1.04$ )<sup>[33-41]</sup>。因此,患者术前沐浴时,无论使用抗菌皂还是非抗菌皂在降低 SSI 的疗效上无显著差异。

**4. 机械性肠道准备与口服抗生素:推荐意见 4:建议术前口服抗生素联合机械性肠道准备以降低接受择期结直肠手术的成年患者发生 SSI 的风险(条件推荐,中等质量证据)。**

**推荐意见 5:不推荐对择期结直肠手术的成年患者只实施机械性肠道准备(不联合口服抗生素)以降低 SSI(强烈推荐,中等质量证据)。**

证据小结:机械性肠道准备指通过口服泻药进行的全肠道清洁。由于可去除粪便负荷、减少细菌数量,理论上可减少术后感染性并发症的发生。肠道准备联合口服抗生素可进一步减轻肠道内的细菌负荷。综合 11 项 RCT 的荟萃分析显示,与仅行机械性肠道准备相比,术前肠道准备联合口服抗生素可显著降低接受择期结直肠手术的成年患者的 SSI 风险( $OR=0.56$ ,  $95\%CI: 0.37\sim 0.83$ ),但是两者在吻合口漏发生率上无差异<sup>[42-52]</sup>。但是,术前仅行机械性肠道准备,与未行肠道准备相比,不会显著降低的 SSI 发生率( $OR=1.31$ ,  $95\%CI: 0.99\sim 1.72$ ),该证据质量为中

等<sup>[53-65]</sup>。但同时须指出,该干预方式只适用于术前;且联合使用口服抗生素和机械性肠道准备不能取代术前的预防性抗生素。

**5. 去除毛发: 推荐意见 6: 不推荐对准备接受手术的患者去除毛发; 如果确有必要, 只能使用剪刀去除毛发。无论是在手术前或在手术室中, 任何情况下均强烈反对使用剃刀去除毛发(强烈推荐, 中等质量证据)。**

证据小结: 去除毛发虽然有利于暴露手术切口和做标记, 但是去除的方法不当可增加皮肤的创伤, 增加 SSI 发生的风险。15 项研究比较了采用剃毛、剪毛、脱毛膏等不同方式去除毛发与不去除毛发对 SSI 发生率的影响<sup>[66-80]</sup>, 发现去除毛发与不去除毛发相比降低 SSI 的疗效差异无统计学意义( $OR=1.78, 95\%CI: 0.96\sim 3.29; OR=1.00; 95\%CI: 0.06\sim 6.34; OR=1.02, 95\%CI: 0.42\sim 2.49$ ), 证据质量为低或极低。不同毛发去除方式的比较则显示, 剪刀较剃刀可显著降低 SSI 发生率( $OR=0.51, 95\%CI: 0.29\sim 0.91$ ), 证据质量为低<sup>[70-71, 74]</sup>。脱毛膏与剃刀相比, 降低 SSI 的疗效差异无统计学意义( $OR=2.78, 95\%CI: 0.86\sim 9.03$ ), 证据质量为极低<sup>[66-68, 78, 80]</sup>。若将剪刀去除毛发与不去除毛发合并, 荟萃分析显示, 其 SSI 发生率显著低于剃毛( $OR=0.51, 95\%CI: 0.34\sim 0.78$ ), 证据质量为中等<sup>[68, 72-73, 75-77, 79]</sup>。去除毛发的时机方面, 手术前去除毛发不会较手术当天去除毛发显著降低 SSI 发生率( $OR=1.22, 95\%CI: 0.44\sim 3.42$ )。

**6. 外科手术预防性抗生素的最佳时机: 推荐意见 7: 推荐必要时在手术切皮前预防性应用抗生素(强烈推荐, 低质量证据)。**

**推荐意见 8: 推荐切皮前 120 min 内给予预防性抗生素, 但同时需考虑抗生素半衰期(强烈推荐, 中等质量证据)。**

证据小结: 预防性抗生素的应用需要选择合适的时机以保证术中抗感染药物在手术部位维持在有效的血药浓度。关于预防性抗生素给药时机的研究只有观察性研究, 缺乏 RCT 研究<sup>[81-93]</sup>。低等级的证据表明, 切皮后应用预防性抗生素较切皮前应用 SSI 发生率显著升高( $OR=1.89, 95\%CI: 1.05\sim 3.40$ )<sup>[81-82, 85, 89]</sup>。中等质量证据显示, 切皮前 120 min 之前给予预防性抗生素较 120 min 之内给药 SSI 发生率显著升高( $OR=5.26, 95\%CI: 3.29\sim 8.39$ )<sup>[81, 83, 89-92]</sup>。切皮前 60 min 内给药较 60~120 min 内给药对 SSI 发生率的降低没有影响, 此证据为低质量; 同样, 切皮前 30 min 内给药较 30~60 min 内给药亦对 SSI 发生率的降低无影响。

**7. 外科手消毒: 推荐意见 9: 推荐戴无菌手套之前用抗菌肥皂和流动水刷手, 或使用含酒精的速干消毒剂进行外科手消毒(强烈推荐, 中等质量证据)。**

证据小结: 比较擦手、刷手对 SSI 影响的循证医学证据有限, 对仅有的研究做荟萃分析显示, 使用含酒精的速干消毒剂消毒与抗菌肥皂或普通肥皂结合流动水刷手在降低 SSI 发生率方面差异无统计学意义。2009 年 WHO 推出的《手卫生指南》明确了外科手消毒的方法<sup>[94]</sup>, 遵从该版指南的消毒方法可有效降低 SSI 发生率。

## (二) 术中和术后预防措施

**1. 维持体温: 推荐意见 10: 建议维持围手术期正常体温(条件推荐, 中等质量证据)。**

证据小结: 术中和术后的低体温是由麻醉引起的体温调节受损和手术室的低温暴露共同导致的。非预期的低体温与心血管并发症增加、凝血功能受损、伤口愈合减缓、免疫功能下降有关, 增加了 SSI 感染的风险。2 项 RCT 比较了术前和术中是否使用保温设备对降低 SSI 发生率的影响, 荟萃分析显示, 在手术时对患者采用保温措施可显著降低 SSI 的发生率( $OR=0.33, 95\%CI: 0.17\sim 0.62$ ), 证据质量为中等<sup>[95-96]</sup>。但是基于目前的研究, 无法对目标体温的具体数值、维持体温的方式和持续时间等形成推荐意见。

**2. 围手术期血糖控制: 推荐意见 11: 无论是否患有糖尿病, 都应控制患者围手术期血糖, 血糖控制的目标可设定为 6.1~8.3 mmol/L, 特殊人群的控制目标应综合判定(条件推荐, 低质量证据)。**

证据小结: 由于手术的应激, 患者在术中和术后均会出现血糖的升高, 而高血糖可增加糖尿病和非糖尿病患者发生 SSI 的风险。系统评价提示, 围手术期严控血糖较常规调控血糖可显著降低 SSI 的发生率( $OR=0.43, 95\%CI: 0.29\sim 0.64$ ), 而且严控血糖降低 SSI 发生风险的效果在糖尿病和非糖尿病患者中均有体现<sup>[97-111]</sup>。血糖调控的时机方面, 只在术中调控血糖( $OR=0.88, 95\%CI: 0.45\sim 1.74$ )降低 SSI 的效果弱于术后调控或术中联合术后调控( $OR=0.47, 95\%CI: 0.25\sim 0.55, P=0.049$ )<sup>[97-111]</sup>。入选的各项研究调控血糖的目标不尽相同, 有以 6.1 mmol/L 为目标, 也有以 6.1~8.3 mmol/L 为目标。虽然不同的调控目标之间差异无统计学意义( $P=0.328$ ), 但是指南编审专家组考虑到较低的血糖控制目标相比较高的目标导致低血糖的可能性更大, 为尽可能避免严苛降糖引起的低血糖, 建议将血糖调控的目标设定为 6.1~8.3 mmol/L。特殊人群血糖调控的目标还需结合患者实际情况有所调整。

**3. 液体治疗: 推荐意见 12: 建议采用目标导向性液体治疗以降低 SSI 风险(条件推荐, 低质量证据)。**

证据小结: 液体治疗是围手术期重要的治疗手段, 也是争论最多的问题之一。限制性液体治疗、目标导向性液体治疗先后被提出并发展, 本指南比较了上述液体治疗策略对 SSI 的影响。低质量的证据表明, 与标准液体治疗相比, 术中目标导向性液体治疗能够显著降低 SSI 的发生率( $OR=0.56, 95\%CI: 0.35\sim 0.88$ )<sup>[112-125]</sup>; 同样, 术后目标导向性液体治疗也可降低 SSI 的发生率( $OR=0.24, 95\%CI: 0.11\sim 0.52$ )<sup>[126-127]</sup>。限制性液体治疗与标准液体治疗相比, 对 SSI 的发生率无影响( $OR=0.73, 95\%CI: 0.41\sim 1.28$ )<sup>[128-132]</sup>。

基于目前的循证医学证据, 指南编审专家组认为术中和术后行目标导向性液体治疗可降低 SSI 发生率, 但是需注意入选的研究设定液体治疗的目标(心脏指数、收缩压、平均动脉压等)各不相同, 并且对正常容量的定义也不相同, 加之可靠的容量评估手段亦缺乏, 未来还需进一步开展研究, 指导围手术期液体管理。

**4. 手术铺巾和手术衣、贴膜: 推荐意见 13:** 无菌的一次性无纺布或可重复利用的手术铺巾和手术衣均可用于预防 SSI (条件推荐, 中到低质量证据)。

**推荐意见 14:** 不论贴膜是否抗菌, 不一定必须使用塑料贴膜预防 SSI (条件推荐, 低到极低质量证据)。

证据小结: 现有指南并未提及一次性或反复使用的铺巾和手术衣降低 SSI 的效果, 而对塑料贴膜降低 SSI 的作用多以否定为主。本指南的系统评价共纳入 11 项研究。其中 5 项研究分析了使用无菌的一次性无纺布和可重复利用的铺巾与手术衣对 SSI 的影响, 发现两者预防 SSI 的效果差异无统计学意义 (RCT:  $OR=0.85$ ,  $95\%CI: 0.66\sim 1.09$ ; OBS:  $OR=1.56$ ,  $95\%CI: 0.89\sim 2.72$ )<sup>[133-137]</sup>。4 项研究比较了切口贴膜对 SSI 发生率的影响, 证据表明, 与未使用切口贴膜相比, 使用含碘的切口贴膜不会降低 SSI 发生率 (RCT:  $OR=2.62$ ,  $95\%CI: 0.68\sim 10.04$ ; OBS:  $OR=0.49$ ,  $95\%CI: 0.16\sim 1.49$ ); 而使用不含碘的切口贴膜也有相似的结果<sup>[138-141]</sup>。因此, 基于现有的循证证据, 专家建议, 不应以预防 SSI 为目的使用抗菌或非抗菌切口贴膜。

**5. 切口保护套: 推荐意见 15:** 腹部清洁-污染切口、污染切口和污秽或感染切口可考虑使用切口保护套 (条件推荐, 极低质量证据)。

证据小结: 切口保护套是一种应用型手术铺巾材料, 可有效绝缘切口与周围组织, 防止血液、体液、冲洗液渗透, 从而减少手术切口污染机会, 并能减少手术对切口组织过分牵拉及破坏, 从而降低切口感染风险。从 11 项研究 (10 项 RCT, 1 项非随机前瞻性对照研究) 得到的证据表明, 与传统的手术铺巾保护切口相比, 无论是单环还是双环的切口保护套, 均可显著降低 SSI 的发生率 ( $OR=0.42$ ,  $95\%CI: 0.28\sim 0.62$ ), 证据质量为极低。但 Meta 回归比较单环切口保护套与双环切口保护套降低 SSI 发生率的差异无统计学意义 ( $P=0.107$ )<sup>[142-152]</sup>。对不同级别切口行亚组分析显示, 切口保护套在降低清洁-污染切口 ( $P=0.244$ )、污染切口 ( $P=0.305$ )、污秽或感染切口 ( $P=0.675$ ) 的 SSI 发生率方面差异无统计学意义。考虑到证据质量为极低以及切口保护套本身的费用, 指南编审专家组建议只在腹部清洁-污染切口、污染切口和污秽或感染切口中使用。

**6. 切口冲洗: 推荐意见 16:** 可考虑在关闭切口前使用聚维酮碘溶液冲洗切口, 特别是清洁切口和清洁-污染切口。不应以预防 SSI 为目的, 在关闭切口前使用抗生素溶液冲洗切口 (条件推荐, 低质量证据)。

证据小结: 由于循证医学证据有限, 本推荐意见只涉及切口冲洗, 不包括腹腔灌洗和纵隔灌洗。使用聚维酮碘溶液冲洗切口有利于降低 SSI ( $OR=0.31$ ,  $95\%CI: 0.13\sim 0.73$ ,  $P=0.007$ )<sup>[153-156]</sup>。此外, 综合 5 项 RCT 的荟萃分析表明, 使用抗生素溶液冲洗切口和不冲洗或与生理盐水冲洗对比, SSI 的发生率差异无统计学意义 ( $OR=1.16$ ,  $95\%CI: 0.64\sim 2.12$ ,  $P=0.63$ ), 证据质量为极低<sup>[157-161]</sup>。

**7. 预防性伤口负压治疗: 推荐意见 17:** 对高风险的一期

缝合切口, 建议预防性使用伤口负压治疗 (条件推荐, 低质量证据)。

证据小结: 来自 19 篇文献的 20 项研究 (包括 5 篇文献中的 6 项 RCT<sup>[162-166]</sup>, 14 项 OBS<sup>[167-180]</sup>) 分析了负压伤口疗法降低 SSI 发生率的效果, 其结果显示, 与传统的敷料相比, 预防性伤口负压治疗可降低一期缝合切口发生 SSI 的风险 (RCT:  $OR=0.56$ ,  $95\%CI: 0.32\sim 0.96$ ; OBS:  $OR=0.30$ ,  $95\%CI: 0.22\sim 0.42$ )。针对不同术式的亚组分析显示, 腹部手术和心脏手术使用该预防措施可显著降低 SSI 的发生率。在不同级别切口间的亚组分析显示, 预防性伤口负压治疗能明显降低清洁-污染切口 (OBS:  $OR=0.29$ ,  $95\%CI: 0.17\sim 0.50$ )、清洁切口 (OBS:  $OR=0.27$ ,  $95\%CI: 0.17\sim 0.42$ ) 的 SSI 发生率。

**8. 抗菌涂层缝线: 推荐意见 18:** 建议在全类手术中使用抗菌涂层缝线以预防 SSI (条件推荐, 中等质量证据)。

证据小结: 具有抗菌性能的缝线可减少缝线材料上细菌的定植。为比较抗菌涂层缝线能否更有效减少 SSI 的发生率, 一共 18 项临床研究 (13 项 RCT<sup>[181-193]</sup>, 5 项 OBS<sup>[194-198]</sup>) 被纳入进行系统综述, 纳入研究的抗菌涂层缝线均为含三氯生抗菌剂的缝线。荟萃分析结果显示, 与不含三氯生抗菌剂的普通缝线相比, 抗菌涂层缝线能够显著降低 SSI 的发生率 (RCT:  $OR=0.72$ ,  $95\%CI: 0.59\sim 0.88$ ; OBS:  $OR=0.58$ ,  $95\%CI: 0.40\sim 0.83$ ), 证据质量为中等。对于具体的缝线类型, 抗菌 Vicryl Plus 缝线较普通 Vicryl 缝线能显著降低 SSI 的发生率 (RCT:  $OR=0.62$ ,  $95\%CI: 0.44\sim 0.88$ ; OBS:  $OR=0.58$ ,  $95\%CI: 0.37\sim 0.92$ )。Meta 回归分析显示, 抗菌涂层缝线降低 SSI 的疗效与手术方式、切口类型、缝线编织方式等均无关<sup>[181-198]</sup>。基于目前的循证证据, 指南编审专家组建议在任何术式中均可使用抗菌涂层缝线以降低 SSI 发生率。

**9. 引流放置时的预防性抗生素与引流移除的时机: 推荐意见 19:** 不建议因存在切口引流而延长围手术期预防性抗生素的使用 (条件推荐, 低质量证据)。

**推荐意见 20:** 建议根据临床实际情况拔除切口引流。尚无证据支持拔除切口引流的最佳时机 (条件推荐, 极低质量证据)。

证据小结: 通过对 7 项 RCT 的荟萃分析表明, 与仅在切口前单剂量预防性抗生素相比, 因为存在切口引流而延长预防性抗生素不能降低 SSI 的发生率 ( $OR=0.79$ ,  $95\%CI: 0.53\sim 1.20$ ), 证据质量为低<sup>[199-205]</sup>。考虑到无证据支持存在引流管时延长用药可预防 SSI 以及抗生素应用可能导致的不良后果, 指南编审专家组一致不建议以预防 SSI 为目的延长预防性抗生素。

另由 11 项 RCT 提供的证据表明, 早期拔除切口引流 (术后 12 h、24 h、48 h) 与术后 3~5 d 拔除引流对 SSI 的影响差异无统计学意义 ( $OR=0.86$ ,  $95\%CI: 0.49\sim 1.50$ ), 证据质量为极低<sup>[206-216]</sup>。基于目前的循证证据质量, 专家组认为, 应根据临床实际情况, 拔除切口引流。

**10. 切口敷料: 推荐意见 21:** 不建议以预防 SSI 为目的在二期缝合的切口上应用特殊敷料 (条件推荐, 低质量证据)。

证据小结:近年来,亲水胶体、纤维胶体、凝胶、聚氨酯矩阵敷料和蒸汽渗透膜敷料等多种特殊敷料相继问世。为比较特殊敷料与普通敷料降低SSI发生率的效果,综合10项RCT进行系统评价的结果显示,相比普通敷料,特殊敷料并不能显著降低SSI发生率( $OR=0.80, 95\%CI: 0.52\sim 1.23$ )<sup>[217-226]</sup>。因此,指南编审专家组不建议以预防SSI为目的使用特殊敷料。

**11. 延长预防性抗生素使用时间: 推荐意见 22: 不推荐以预防SSI为目的延长术后预防性抗生素的使用时间(强烈推荐, 中等质量证据)。**

证据小结:常规使用预防性抗生素的效果众所周知,但关于术后抗生素的持续时间仍然存在相当多的争议。大多数指南推荐,预防性抗生素最长可延长至术后24 h,但有越来越多的证据表明术前单剂量给药(含手术时间长导致术中增加给药)的效果不劣于术后继续给药。为避免延长用药可能带来的抗生素耐药,指南编审专家组认为,在手术结束后,不应以预防SSI为目的继续给药。

**结语** SSI是一类顽固但可预防的HAI,制定全面的SSI的预防措施尚需更多高质量的循证医学证据。本共识基于现有的医学研究结果并结合中国临床实践,经过专家反复多次讨论而最终形成,但仍存在一定的局限性。比如由于循证医学证据有限,术前皮肤消毒、围手术期氧合等预防措施尚未形成推荐意见,这些未解决的问题仍需要在未来进行更多研究。需注意的是,临床医生在应用推荐意见时应结合所在医院的条件,根据患者的具体情况而定,以提高患者的安全。

#### 编审专家组名单

**组长:**任建安[东部战区总医院(原南京军区南京总医院)]  
**成员(按姓名汉语拼音首字母排序):**安友仲(北京大学人民医院)、陈超武(湖南省人民医院)、迟强(哈尔滨医科大学附属第二医院)、杜斌(中国医学科学院北京协和医院)、范朝刚[东部战区总医院(原南京军区南京总医院)]、顾国胜[东部战区总医院(原南京军区南京总医院)]、管向东(中山大学附属第一医院)、韩刚(吉林大学第二医院)、黄志勇(华中科技大学同济医学院附属同济医院)、李国逊(天津市人民医院)、李洪涛(解放军联勤保障部队第九四〇医院)、李世宽(青岛大学附属医院)、李玉民(兰州大学第二医院)、梁斌(北京大学人民医院)、刘洪俊(山东省立医院)、刘玉琪(福建医科大学附属第二医院)、刘正才(空军军医大学第一附属医院)、马涛(天津医科大学总医院)、仇毓东(南京大学医学院附属鼓楼医院)、任建安[东部战区总医院(原南京军区南京总医院)]、孙宝友(山东省立医院)、唐云(解放军总医院海南医院)、王革非[东部战区总医院(原南京军区南京总医院)]、王建忠(赣南医学院第一附属医院)、王培戈(青岛大学附属医院)、王铮(西安交通大学第一附属医院)、王志明(中南大学湘雅医院)、武华(山西医科大学第一医院)、伍晓汀(四川大学华西医院)、吴秀文[东部战区总医院(原南京军区南京总医院)]、许戈良(安徽省立医院)、颜荣林(海军军医大学

附属长征医院)、杨士民(天津市南开医院)、杨振华(湖北宜昌市中心人民医院)、于文胜(山东潍坊市人民医院)、张平(吉林大学白求恩第一医院)、张匀(浙江大学医学院附属第二医院)、赵海鹰(中国医科大学附属第四医院)、赵允召[东部战区总医院(原南京军区南京总医院)]

**执笔:**吴秀文[东部战区总医院(原南京军区南京总医院)]

#### 参 考 文 献

- [1] World Health Organization. Report on the endemic burden of healthcare-associated infection worldwide [M]. Geneva: WHO Press, 2011: 6-7.
- [2] Allegranzi B, Bagheri NS, Combescure C, et al. Burden of endemic health - care - associated infection in developing countries: systematic review and meta - analysis [J]. Lancet, 2011, 377 (9761): 228-241. DOI: 10.1016/S0140-6736(10)61458-4.
- [3] Mangram AJ, Horan TC, Pearson ML, et al. Guideline for prevention of surgical site infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee [J]. Am J Infect Control, 1999, 27(2): 97-134.
- [4] Berríos-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017 [J]. JAMA Surg, 2017, 152(8): 784-791. DOI: 10.1001/jamasurg.2017.0904.
- [5] National Institute for Health and Care Excellence. Surgical site infections: prevention and treatment [EB/OL]. London: National Institute for Health and Care Excellence, 2008. [2019-02-25]. <https://www.nice.org.uk/guidance/cg74>.
- [6] Anderson DJ, Podgorny K, Berríos-Torres SI, et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update [J]. Infect Control Hosp Epidemiol, 2014, 35 Suppl 2: S66-S88.
- [7] World Health Organization. Global Guidelines for the prevention of surgical site infection [M]. Geneva: WHO Press, 2016: 15-20.
- [8] 卫生部. 外科手术部位感染预防与控制技术指南(试行). 2010-11-29.
- [9] Guyatt G, Oxman AD, Akl EA, et al. GRADE guidelines: 1. Introduction- GRADE evidence profiles and summary of findings tables [J]. J Clin Epidemiol, 2011, 64(4): 383-394. DOI: 10.1016/j.jclinepi.2010.04.026.
- [10] Celik JB, Gezginç K, Özçelik K, et al. The role of immunonutrition in gynecologic oncologic surgery [J]. Eur J Gynaecol Oncol, 2009, 30(4): 418-421.
- [11] Falewee MN, Schilf A, Boufflers E, et al. Reduced infections with perioperative immunonutrition in head and neck cancer: exploratory results of a multicenter, prospective, randomized, double-blind study [J]. Clin Nutr, 2014, 33(5): 776-784. DOI: 10.1016/j.clnu.2013.10.006.
- [12] Fujitani K, Tsujinaka T, Fujita J, et al. Prospective randomized

- trial of preoperative enteral immunonutrition followed by elective total gastrectomy for gastric cancer [J]. *Br J Surg*, 2012, 99(5): 621-629. DOI: 10.1002/bjs.8706.
- [13] Gianotti L, Braga M, Nespoli L, et al. A randomized controlled trial of preoperative oral supplementation with a specialized diet in patients with gastrointestinal cancer [J]. *Gastroenterology*, 2002, 122(7): 1763-1770. DOI: 10.1053/gast.2002.33587.
- [14] Klek S, Sierzega M, Szybinski P, et al. The immunomodulating enteral nutrition in malnourished surgical patients - a prospective, randomized, double-blind clinical trial [J]. *Clin Nutr*, 2011, 30(3): 282-288. DOI: 10.1016/j.clnu.2010.10.001.
- [15] Snyderman CH, Kachman K, Molseed L, et al. Reduced postoperative infections with an immune-enhancing nutritional supplement [J]. *Laryngoscope*, 1999, 109(6): 915-921. DOI: 10.1097/00005537-199906000-00014.
- [16] Tepaske R, Velthuis H, Oudemans-van SHM, et al. Effect of preoperative oral immune-enhancing nutritional supplement on patients at high risk of infection after cardiac surgery: a randomised placebo-controlled trial [J]. *Lancet*, 2001, 358(9283): 696-701. DOI: 10.1016/S0140-6736(01)05836-6.
- [17] Tepaske R, te VH, Oudemans-van SHM, et al. Glycine does not add to the beneficial effects of perioperative oral immune-enhancing nutrition supplements in high-risk cardiac surgery patients [J]. *JPEN J Parenter Enteral Nutr*, 2007, 31(3): 173-180. DOI: 10.1177/0148607107031003173.
- [18] Horie H, Okada M, Kojima M, et al. Favorable effects of preoperative enteral immunonutrition on a surgical site infection in patients with colorectal cancer without malnutrition [J]. *Surg Today*, 2006, 36(12): 1063-1068. DOI: 10.1007/s00595-006-3320-8.
- [19] Takeuchi H, Ikeuchi S, Kawaguchi Y, et al. Clinical significance of perioperative immunonutrition for patients with esophageal cancer [J]. *World J Surg*, 2007, 31(11): 2160-2167. DOI: 10.1007/s00268-007-9219-8.
- [20] Casas - Rodera P, Gómez - Candela C, Benítez S, et al. Immunoenhanced enteral nutrition formulas in head and neck cancer surgery: a prospective, randomized clinical trial [J]. *Nutr Hosp*, 23(2): 105-110.
- [21] De Luis DA, Izaola O, Cuellar L, et al. Effect of c-reactive protein and interleukins blood levels in postsurgery arginine-enhanced enteral nutrition in head and neck cancer patients [J]. *Eur J Clin Nutr*, 2003, 57(1): 96-99. DOI: 10.1038/sj.ejcn.1601512.
- [22] De Luis DA, Izaola O, Cuellar L, et al. Randomized clinical trial with an enteral arginine-enhanced formula in early postsurgical head and neck cancer patients [J]. *Eur J Clin Nutr*, 2004, 58(11): 1505-1508. DOI: 10.1038/sj.ejcn.1601999.
- [23] De Luis DA, Izaola O, Cuellar L, et al. High dose of arginine enhanced enteral nutrition in postsurgical head and neck cancer patients. a randomized clinical trial [J]. *Eur Rev Med Pharmacol Sci*, 2009, 13(4): 279-283.
- [24] Okabayashi T, Nishimori I, Sugimoto T, et al. Effects of branched-chain amino acids-enriched nutrient support for patients undergoing liver resection for hepatocellular carcinoma [J]. *J Gastroenterol Hepatol*, 2008, 23(12): 1869-1873. DOI: 10.1111/j.1440-1746.2008.05504.x.
- [25] Sany J, Anaya JM, Canovas F, et al. Influence of methotrexate on the frequency of postoperative infectious complications in patients with rheumatoid arthritis [J]. *J Rheumatol*, 1993, 20(7): 1129-1132.
- [26] Grennan DM, Gray J, Loudon J, et al. Methotrexate and early postoperative complications in patients with rheumatoid arthritis undergoing elective orthopaedic surgery [J]. *Ann Rheum Dis*, 2001, 60(3): 214-217. DOI: 10.1136/ard.60.3.214.
- [27] Berthold E, Geborek P, Gülfe A. Continuation of TNF blockade in patients with inflammatory rheumatic disease. an observational study on surgical site infections in 1,596 elective orthopedic and hand surgery procedures [J]. *Acta Orthop*, 2013, 84(5): 495-501. DOI: 10.3109/17453674.2013.842431.
- [28] Bridges SL, López - Méndez A, Han KH, et al. Should methotrexate be discontinued before elective orthopedic surgery in patients with rheumatoid arthritis? [J]. *J Rheumatol*, 1991, 18(7): 984-988.
- [29] Carpenter MT, West SG, Vogelgesang SA, et al. Postoperative joint infections in rheumatoid arthritis patients on methotrexate therapy [J]. *Orthopedics*, 1996, 19(3): 207-210.
- [30] Colombel JF, Loftus EV, Tremaine WJ, et al. Early postoperative complications are not increased in patients with Crohn's disease treated perioperatively with infliximab or immunosuppressive therapy [J]. *Am J Gastroenterol*, 2004, 99(5): 878-883. DOI: 10.1111/j.1572-0241.2004.04148.x.
- [31] Den Broeder AA, Creemers MC, Fransen J, et al. Risk factors for surgical site infections and other complications in elective surgery in patients with rheumatoid arthritis with special attention for anti-tumor necrosis factor: a large retrospective study [J]. *J Rheumatol*, 2007, 34(4): 689-695.
- [32] Murata K, Yasuda T, Ito H, et al. Lack of increase in postoperative complications with low-dose methotrexate therapy in patients with rheumatoid arthritis undergoing elective orthopedic surgery [J]. *Mod Rheumatol*, 2006, 16(1): 14-19. DOI: 10.1007/s10165-005-0444-4.
- [33] Byrne D, Napier A, Cuschieri A. Prevention of postoperative wound infection in clean and potentially contaminated surgery. a prospective, randomised, double-blind, placebo-controlled clinical trial [J]. *Surg Res Commun*, 1992, 12(1): 43-52.
- [34] Lynch W, Davey PG, Malek M, et al. Cost-effectiveness analysis of the use of chlorhexidine detergent in preoperative whole-body disinfection in wound infection prophylaxis [J]. *J Hosp Infect*, 1992, 21(3): 179-191. DOI: 10.1016/0195-6701(92)90074-V.
- [35] Rotter ML. A placebo-controlled trial of the effect of two preoperative baths or showers with chlorhexidine detergent on postoperative wound infection rates [J]. *J Hosp Infect*, 1988, 12(2): 137-138. DOI: 10.1016/0195-6701(88)90142-9.

- [36] Earnshaw JJ, Berridge DC, Slack RC, et al. Do preoperative chlorhexidine baths reduce the risk of infection after vascular reconstruction? [J]. *Eur J Vasc Surg*, 1989, 3 (4) : 323-326. DOI: 10.1016/S0950-821X(89)80068-4.
- [37] Hayek LJ, Emerson JM. Preoperative whole body disinfection--a controlled clinical study [J]. *J Hosp Infect*, 1988, 11 Suppl B: 15-19. DOI: 10.1016/0195-6701(88)90151-X
- [38] Randall PE, Ganguli LA, Keaney MG, et al. Prevention of wound infection following vasectomy [J]. *Br J Urol*, 1985, 57(2) : 227-229.
- [39] Veiga DF, Damasceno CA, Veiga-Filho J, et al. Randomized controlled trial of the effectiveness of chlorhexidine showers before elective plastic surgical procedures [J]. *Infect Control Hosp Epidemiol*, 2009, 30(1): 77-79. DOI: 10.1086/592980.
- [40] Ayliffe GA, Noy MF, Babb JR, et al. A comparison of pre-operative bathing with chlorhexidine - detergent and non-medicated soap in the prevention of wound infection [J]. *J Hosp Infect*, 1983, 4 (3) : 237-244. DOI: 10.1016/0195-6701 (83) 90024-5.
- [41] Leigh DA, Stronge JL, Marriner J, et al. Total body bathing with 'Hibiscrub' (chlorhexidine) in surgical patients; a controlled trial [J]. *J Hosp Infect*, 1983, 4 (3) : 229-235. DOI: 10.1016/0195-6701(83)90023-3.
- [42] Espin-Basany E, Sanchez-Garcia JL, Lopez-Cano M, et al. Prospective, randomised study on antibiotic prophylaxis in colorectal surgery. is it really necessary to use oral antibiotics? [J]. *Int J Colorectal Dis*, 2005, 20(6) : 542-546. DOI: 10.1007/s00384-004-0736-8.
- [43] Horie T. Randomized controlled trial on the necessity of chemical cleaning as preoperative preparation for colorectal cancer surgery [J]. *Dokkyo J Med Sci*, 2007, 34(3) : 205-212.
- [44] Ishida H, Yokoyama M, Nakada H, et al. Impact of oral antimicrobial prophylaxis on surgical site infection and methicillin - resistant *Staphylococcus aureus* infection after elective colorectal surgery. results of a prospective randomized trial [J]. *Surg Today*, 2001, 31 (11) : 979-983. DOI: 10.1007/s005950170006.
- [45] Kobayashi M, Mohri Y, Tonouchi H, et al. Randomized clinical trial comparing intravenous antimicrobial prophylaxis alone with oral and intravenous antimicrobial prophylaxis for the prevention of a surgical site infection in colorectal cancer surgery [J]. *Surg Today*, 2007, 37(5) : 383-388. DOI: 10.1007/s00595-006-3410-7.
- [46] Lewis RT. Oral versus systemic antibiotic prophylaxis in elective colon surgery: a randomized study and meta-analysis send a message from the 1990s [J]. *Can J Surg*, 2002, 45(3) : 173-180.
- [47] Oshima T, Takesue Y, Ikeuchi H, et al. Preoperative oral antibiotics and intravenous antimicrobial prophylaxis reduce the incidence of surgical site infections in patients with ulcerative colitis undergoing IPAA [J]. *Dis Colon Rectum*, 2013, 56(10) : 1149-1155. DOI: 10.1097/DCR.0b013e31829f71a0.
- [48] Roos D, Dijkstra LM, Oudemans-van Straaten HM, et al. Randomized clinical trial of perioperative selective decontamination of the digestive tract versus placebo in elective gastrointestinal surgery [J]. *Br J Surg*, 2011, 98 (10) : 1365-1372. DOI: 10.1002/bjs.7631.
- [49] Sadahiro S, Suzuki T, Tanaka A, et al. Comparison between oral antibiotics and probiotics as bowel preparation for elective colon cancer surgery to prevent infection: prospective randomized trial [J]. *Surgery*, 2014, 155 (3) : 493-503. DOI: 10.1016/j.surg.2013.06.002.
- [50] Stellato TA, Danziger LH, Gordon N, et al. Antibiotics in elective colon surgery. a randomized trial of oral, systemic, and oral/systemic antibiotics for prophylaxis [J]. *Am Surg*, 1990, 56(4) : 251-254.
- [51] Takesue Y, Yokoyama T, Akagi S, et al. A brief course of colon preparation with oral antibiotics [J]. *Surg Today*, 2000, 30(2) : 112-116. DOI: 10.1007/PL00010059.
- [52] Taylor EW, Lindsay G. Selective decontamination of the colon before elective colorectal surgery. West of Scotland Surgical Infection Study Group [J]. *World J Surg*, 1994, 18(6) : 926-932.
- [53] Barrera E, Cid B, Bannura C, et al. Usefulness of anterograde mechanical bowel cleansing in elective colorectal surgery. results of a prospective randomized study [J]. *Rev Chil Cir*, 2012, 64(4) : 373-377.
- [54] Bretagnol F, Panis Y, Rullier E, et al. Rectal cancer surgery with or without bowel preparation: the French GRECCAR III multicenter single-blinded randomized trial [J]. *Ann Surg*, 2010, 252(5) : 863-868. DOI: 10.1097/SLA.0b013e3181fd8ea9.
- [55] Bucher P, Gervaz P, Soravia C, et al. Randomized clinical trial of mechanical bowel preparation versus no preparation before elective left-sided colorectal surgery [J]. *Br J Surg*, 2005, 92(4) : 409-414. DOI: 10.1002/bjs.4900.
- [56] Burke P, Mealy K, Gillen P, et al. Requirement for bowel preparation in colorectal surgery [J]. *Br J Surg*, 1994, 81 (6) : 907-910. DOI: 10.1002/bjs.1800810639.
- [57] Contant CM, Hop WC, van't Sant HP, et al. Mechanical bowel preparation for elective colorectal surgery: a multicentre randomised trial [J]. *Lancet*, 2007, 370 (9605) : 2112-2117. DOI: 10.1016/S0140-6736(07)61905-9.
- [58] Fa-Si-Oen P, Roumen R, Buitenweg J, et al. Mechanical bowel preparation or not? outcome of a multicenter, randomized trial in elective open colon surgery [J]. *Dis Colon Rectum*, 2005, 48 (8) : 1509-1516. DOI: 10.1007/s10350-005-0068-y.
- [59] Jung B, Pahlman L, Nyström PO, et al. Multicentre randomized clinical trial of mechanical bowel preparation in elective colonic resection [J]. *Br J Surg*, 2007, 94(6) : 689-695. DOI: 10.1002/bjs.5816.
- [60] Miettinen RP, Laitinen ST, Mäkelä JT, et al. Bowel preparation with oral polyethylene glycol electrolyte solution vs. no preparation in elective open colorectal surgery: prospective, randomized study [J]. *Dis Colon Rectum*, 2000, 43(5) : 669-677.
- [61] Pena-Soria MJ, Mayol JM, Anula R, et al. Single-blinded randomized trial of mechanical bowel preparation for colon

- surgery with primary intraperitoneal anastomosis [J]. *J Gastrointest Surg*, 2008, 12 (12) : 2103-2109. DOI: 10.1007/s11605-008-0706-5.
- [62] Ram E, Sherman Y, Weil R, et al. Is mechanical bowel preparation mandatory for elective colon surgery? a prospective randomized study[J]. *Arch Surg*, 2005, 140(3) :285-288. DOI: 10.1001/archsurg.140.3.285.
- [63] Santos JC Jr, Batista J, Sirimarco MT, et al. Prospective randomized trial of mechanical bowel preparation in patients undergoing elective colorectal surgery[J]. *Br J Surg*, 1994,81(11) : 1673-1676. DOI:10.1002/bjs.1800811139.
- [64] Young TF, Celis ZJ, Berrospi EF, et al. [Mechanical preparation in elective colorectal surgery, a usual practice or a necessity?][J]. *Rev Gastroenterol Peru*, 2002,22(2):152-158.
- [65] Zmora O, Mahajna A, Bar-Zakai B, et al. Colon and rectal surgery without mechanical bowel preparation: a randomized prospective trial[J]. *Ann Surg*, 2003,237(3):363-367. DOI: 10.1097/01.SLA.0000055222.90581.59.
- [66] Thur de Koos P, McComas B. Shaving versus skin depilatory cream for preoperative skin preparation. a prospective study of wound infection rates[J]. *Am J Surg*, 1983,145(3):377-378.
- [67] Goëau - Brissonnière O, Coignard S, Merço AP, et al. [Preoperative skin preparation. a prospective study comparing a depilatory agent in shaving][J]. *Presse Med*, 1987, 16 (31) : 1517-1519.
- [68] Abouzari M, Sodagari N, Hasibi M, et al. Re: Nonshaved cranial surgery in black Africans: a short - term prospective preliminary study (Adeleye and Olowookere, *Surg Neurol* 2008; 69-72) effect of hair on surgical wound infection after cranial surgery: a 3-armed randomized clinical trial [J]. *Surg Neurol*, 2009, 71(2) :261-262. DOI: 10.1016/j.surneu.2008.01.059.
- [69] Adisa AO, Lawal OO, Adejuyigbe O. Evaluation of two methods of preoperative hair removal and their relationship to postoperative wound infection[J]. *J Infect Dev Ctries*, 2011, 5 (10) :717-722.
- [70] Alexander JW, Fischer JE, Boyajian M, et al. The influence of hair-removal methods on wound infections[J]. *Arch Surg*, 1983, 118 (3) : 347-352. DOI: 10.1001/archsurg.1983.01390030079 013.
- [71] Balthazar ER, Colt JD, Nichols RL. Preoperative hair removal: a random prospective study of shaving versus clipping[J]. *South Med J*, 1982,75(7):799-801. DOI: 10.1097/00007611-198207 000-00006.
- [72] Celik SE, Kara A. Does shaving the incision site increase the infection rate after spinal surgery?[J]. *Spine (Phila Pa 1976)*, 2007, 32 (15) : 1575 - 1577. DOI: 10.1097/BRS.0b013e31807 4c39f.
- [73] Court-Brown CM. Preoperative skin depilation and its effect on postoperative wound infections[J]. *J R Coll Surg Edinb*, 1981, 26(4):238-241.
- [74] Grober ED, Domes T, Fanipour M, et al. Preoperative hair removal on the male genitalia: clippers vs. razors[J]. *J Sex Med*, 2013, 10(2):589-594. DOI:10.1111/j.1743-6109.2012.02904.x.
- [75] Horgan MA, Kernan JC, Schwartz MS, et al. Shaveless brain surgery: safe, well tolerated, and cost effective[J]. *Skull Base Surg*, 1999,9(4):253-258.
- [76] Ilankovan V, Starr DG. Preoperative shaving: patient and surgeon preferences and complications for the gillies incision[J]. *J R Coll Surg Edinb*, 1992,37(6):399-401.
- [77] Kattipattanapong W, Isaradisaiikul S, Hanprasertpong C. Surgical site infections in ear surgery: hair removal effect; a preliminary, randomized trial study[J]. *Otolaryngol Head Neck Surg*, 2013, 148(3) :469-474. DOI:10.1177/0194599812472297.
- [78] Powis SJ, Waterworth TA, Arkell DG. Preoperative skin preparation: clinical evaluation of depilatory cream[J]. *Br Med J*, 1976,2(6045):1166-1168. DOI:10.1136/bmj.2.6045.1166.
- [79] Rojanapirom S, Danchaivijitr S. Pre - operative shaving and wound infection in appendectomy[J]. *J Med Assoc Thai*, 1992, 75 Suppl 2:20-23.
- [80] Seropian R, Reynolds BM. Wound infections after preoperative depilatory versus razor preparation[J]. *Am J Surg*, 1971, 121(3) : 251-254. DOI:10.1016/0002-9610(71)90199-1.
- [81] Classen DC, Evans RS, Pestotnik SL, et al. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection[J]. *N Engl J Med*, 1992,326(5) :281-286. DOI: 10.1056/NEJM199201303260501.
- [82] Van Kasteren ME, Manniën J, Ott A, et al. Antibiotic prophylaxis and the risk of surgical site infections following total hip arthroplasty: timely administration is the most important factor[J]. *Clin Infect Dis*, 2007,44(7):921-927. DOI:10.1086/ 512192.
- [83] Weber WP, Marti WR, Zwahlen M, et al. The timing of surgical antimicrobial prophylaxis[J]. *Ann Surg*, 2008,247(6) :918-926. DOI: 10.1097/SLA.0b013e31816c3fec.
- [84] Steinberg JP, Braun BI, Hellinger WC, et al. Timing of antimicrobial prophylaxis and the risk of surgical site infections: results from the trial to reduce antimicrobial prophylaxis errors [J]. *Ann Surg*, 2009,250(1) :10-16. DOI:10.1097/SLA.0b013 e3181ad5fca.
- [85] Ho VP, Barie PS, Stein SL, et al. Antibiotic regimen and the timing of prophylaxis are important for reducing surgical site infection after elective abdominal colorectal surgery [J]. *Surg Infect (Larchmt)*, 2011, 12 (4) : 255-260. DOI: 10.1089/sur. 2010.073.
- [86] Koch CG, Nowicki ER, Rajeswaran J, et al. When the timing is right: antibiotic timing and infection after cardiac surgery [J]. *J Thorac Cardiovasc Surg*, 2012, 144(4) : 931-937. DOI: 10.1016/j.jtcvs.2012.01.087.
- [87] Koch CG, Li L, Hixson E, et al. Is it time to refine? an exploration and simulation of optimal antibiotic timing in general surgery[J]. *J Am Coll Surg*, 2013, 217(4) :628-635. DOI: 10.1016/j.jamcollsurg.2013.05.024.
- [88] El-Mahallawy HA, Hassan SS, Khalifa HI, et al. Comparing a combination of penicillin G and gentamicin to a combination of



- clindamycin and amikacin as prophylactic antibiotic regimens in prevention of clean contaminated wound infections in cancer surgery[J]. *J Egypt Natl Canc Inst*, 2013, 25(1):31-35. DOI: 10.1016/j.jnci.2012.12.001.
- [89] Muñoz PE, Jiménez AJA, Brea ZS, et al. [The effect of surgical antibiotic prophylaxis and the timing of its administration on the risk of surgical wound infection] [J]. *Rev Clin Esp*, 1995, 195(10):669-673.
- [90] Lizón-García M, García-Caballero J, Asensio-Vegas A. Risk factors for surgical - wound infection in general surgery: a prospective study [J]. *Infect Control Hosp Epidemiol*, 1997, 18(5):310-315.
- [91] Trick WE, Scheckler WE, Tokars JI, et al. Modifiable risk factors associated with deep sternal site infection after coronary artery bypass grafting[J]. *J Thorac Cardiovasc Surg*, 2000, 119(1):108-114.
- [92] Garey KW, Dao T, Chen H, et al. Timing of vancomycin prophylaxis for cardiac surgery patients and the risk of surgical site infections [J]. *J Antimicrob Chemother*, 2006, 58(3):645-650. DOI:10.1093/jac/dkl279.
- [93] Kasatpibal N, Nørgaard M, Sørensen HT, et al. Risk of surgical site infection and efficacy of antibiotic prophylaxis: a cohort study of appendectomy patients in Thailand [J]. *BMC Infect Dis*, 2006, 6:111. DOI:10.1186/1471-2334-6-111.
- [94] World Health Organization. WHO guidelines on hand hygiene in health care. Geneva: World Health Organization [M]. Geneva: WHO Press, 2009:49-53.
- [95] Kurz A, Sessler DI, Lenhardt R. Perioperative normothermia to reduce the incidence of surgical - wound infection and shorten hospitalization. Study of Wound Infection and Temperature Group [J]. *N Engl J Med*, 1996, 334(19):1209-1215. DOI:10.1056/NEJM199605093341901.
- [96] Melling AC, Ali B, Scott EM, et al. Effects of preoperative warming on the incidence of wound infection after clean surgery: a randomised controlled trial [J]. *Lancet*, 2001, 358(9285):876-880. DOI:10.1016/S0140-6736(01)06071-8.
- [97] Abdelmalak BB, Bonilla A, Mascha EJ, et al. Dexamethasone, light anaesthesia, and tight glucose control (DeLiT) randomized controlled trial [J]. *Br J Anaesth*, 2013, 111(2):209-221. DOI: 10.1093/bja/aet050.
- [98] Albacker T, Carvalho G, Schrickler T, et al. High-dose insulin therapy attenuates systemic inflammatory response in coronary artery bypass grafting patients [J]. *Ann Thorac Surg*, 2008, 86(1):20-27. DOI:10.1016/j.athoracsur.2008.03.046.
- [99] Bilotta F, Spinelli A, Giovannini F, et al. The effect of intensive insulin therapy on infection rate, vasospasm, neurologic outcome, and mortality in neurointensive care unit after intracranial aneurysm clipping in patients with acute subarachnoid hemorrhage: a randomized prospective pilot trial [J]. *J Neurosurg Anesthesiol*, 2007, 19(3):156-160. DOI: 10.1097/ANA.0b013e3180338e69.
- [100] Cao S, Zhou Y, Chen D, et al. Intensive versus conventional insulin therapy in nondiabetic patients receiving parenteral nutrition after D2 gastrectomy for gastric cancer: a randomized controlled trial [J]. *J Gastrointest Surg*, 2011, 15(11):1961-1968. DOI:10.1007/s11605-011-1654-z.
- [101] Cao SG, Ren JA, Shen B, et al. Intensive versus conventional insulin therapy in type 2 diabetes patients undergoing D2 gastrectomy for gastric cancer: a randomized controlled trial [J]. *World J Surg*, 2011, 35(1):85-92. DOI:10.1007/s00268-010-0797-5.
- [102] Chan RP, Galas FR, Hajjar LA, et al. Intensive perioperative glucose control does not improve outcomes of patients submitted to open-heart surgery: a randomized controlled trial [J]. *Clinics (Sao Paulo)*, 2009, 64(1):51-60.
- [103] Desai SP, Henry LL, Holmes SD, et al. Strict versus liberal target range for perioperative glucose in patients undergoing coronary artery bypass grafting: a prospective randomized controlled trial [J]. *J Thorac Cardiovasc Surg*, 2012, 143(2):318-325. DOI:10.1016/j.jtcvs.2011.10.070.
- [104] Emam IA, Allan A, Eskander K, et al. Our experience of controlling diabetes in the peri-operative period of patients who underwent cardiac surgery [J]. *Diabetes Res Clin Pract*, 2010, 88(3):242-246. DOI:10.1016/j.diabres.2010.03.002.
- [105] Gandhi GY, Nuttall GA, Abel MD, et al. Intensive intraoperative insulin therapy versus conventional glucose management during cardiac surgery: a randomized trial [J]. *Ann Intern Med*, 2007, 146(4):233-243. DOI:10.7326/0003-4819-146-4-200702200-00002.
- [106] Grey NJ, Perdrizet GA. Reduction of nosocomial infections in the surgical intensive-care unit by strict glycemic control [J]. *Endocr Pract*, 2004, 10 Suppl 2:46-52. DOI:10.4158/EP.10.S2.46.
- [107] Kirdemir P, Yildirim V, Kiris I, et al. Does continuous insulin therapy reduce postoperative supraventricular tachycardia incidence after coronary artery bypass operations in diabetic patients? [J]. *J Cardiothorac Vasc Anesth*, 2008, 22(3):383-387. DOI:10.1053/j.jvca.2007.09.015.
- [108] Lazar HL, McDonnell MM, Chipkin S, et al. Effects of aggressive versus moderate glycemic control on clinical outcomes in diabetic coronary artery bypass graft patients [J]. *Ann Surg*, 2011, 254(3):458-464. DOI:10.1097/SLA.0b013e31822c5d78.
- [109] Okabayashi T, Shima Y, Sumiyoshi T, et al. Intensive versus intermediate glucose control in surgical intensive care unit patients [J]. *Diabetes Care*, 2014, 37(6):1516-1524. DOI:10.2337/dc13-1771.
- [110] Yuan J, Liu T, Zhang X, et al. Intensive versus conventional glycemic control in patients with diabetes during enteral nutrition after gastrectomy [J]. *J Gastrointest Surg*, 2015, 19(8):1553-1558. DOI:10.1007/s11605-015-2871-7.
- [111] Zheng R, Gu C, Wang Y, et al. Impacts of intensive insulin therapy in patients undergoing heart valve replacement [J]. *Heart Surg Forum*, 2010, 13(5):E292-E298. DOI:10.1532/HSF98.20101017.

- [112] Benes J, Chytra I, Altmann P, et al. Intraoperative fluid optimization using stroke volume variation in high risk surgical patients: results of prospective randomized study [J]. *Crit Care*, 2010, 14(3):R118. DOI:10.1186/cc9070.
- [113] Forget P, Lois F, de Kock M. Goal-directed fluid management based on the pulse oximeter - derived pleth variability index reduces lactate levels and improves fluid management [J]. *Anesth Analg*, 2010, 111(4):910-914. DOI:10.1213/ANE.0b013e3181eb624f.
- [114] Gan TJ, Soppitt A, Maroof M, et al. Goal-directed intraoperative fluid administration reduces length of hospital stay after major surgery [J]. *Anesthesiology*, 2002, 97(4):820-826. DOI:10.1097/0000542-200210000-00012.
- [115] Harten J, Crozier JE, McCreath B, et al. Effect of intraoperative fluid optimisation on renal function in patients undergoing emergency abdominal surgery: a randomised controlled pilot study (ISRCTN 11799696) [J]. *Int J Surg*, 2008, 6(3):197-204. DOI:10.1016/j.ijsu.2008.03.002.
- [116] Lopes MR, Oliveira MA, Pereira VO, et al. Goal-directed fluid management based on pulse pressure variation monitoring during high-risk surgery: a pilot randomized controlled trial [J]. *Crit Care*, 2007, 11(5):R100. DOI:10.1186/cc6117.
- [117] Mayer J, Boldt J, Mengistu AM, et al. Goal - directed intraoperative therapy based on autocalibrated arterial pressure waveform analysis reduces hospital stay in high - risk surgical patients: a randomized, controlled trial [J]. *Crit Care*, 2010, 14(1):R18. DOI:10.1186/cc8875.
- [118] Mythen MG, Webb AR. Perioperative plasma volume expansion reduces the incidence of gut mucosal hypoperfusion during cardiac surgery [J]. *Arch Surg*, 1995, 130(4):423-429.
- [119] Pillai P, McEleavy I, Gaughan M, et al. A double - blind randomized controlled clinical trial to assess the effect of doppler optimized intraoperative fluid management on outcome following radical cystectomy [J]. *J Urol*, 2011, 186(6):2201-2206. DOI:10.1016/j.juro.2011.07.093.
- [120] Sandham JD, Hull RD, Brant RF, et al. A randomized, controlled trial of the use of pulmonary-artery catheters in high-risk surgical patients [J]. *N Engl J Med*, 2003, 348(1):5-14. DOI:10.1056/NEJMoa021108.
- [121] Scheeren TW, Wiesenack C, Gerlach H, et al. Goal-directed intraoperative fluid therapy guided by stroke volume and its variation in high-risk surgical patients: a prospective randomized multicentre study [J]. *J Clin Monit Comput*, 2013, 27(3):225-233. DOI:10.1007/s10877-013-9461-6.
- [122] Senagore AJ, Emery T, Luchtfeld M, et al. Fluid management for laparoscopic colectomy: a prospective, randomized assessment of goal - directed administration of balanced salt solution or hetastarch coupled with an enhanced recovery program [J]. *Dis Colon Rectum*, 2009, 52(12):1935-1940. DOI:10.1007/DCR.0b013e3181b4c35e.
- [123] Smetkin AA, Kirov MY, Kuzkov VV, et al. Single transpulmonary thermodilution and continuous monitoring of central venous oxygen saturation during off - pump coronary surgery [J]. *Acta Anaesthesiol Scand*, 2009, 53(4):505-514. DOI:10.1111/j.1399-6576.2008.01855.x.
- [124] Venn R, Steele A, Richardson P, et al. Randomized controlled trial to investigate influence of the fluid challenge on duration of hospital stay and perioperative morbidity in patients with hip fractures [J]. *Br J Anaesth*, 2002, 88(1):65-71.
- [125] Wakeling HG, McFall MR, Jenkins CS, et al. Intraoperative oesophageal doppler guided fluid management shortens postoperative hospital stay after major bowel surgery [J]. *Br J Anaesth*, 2005, 95(5):634-642. DOI:10.1093/bja/aei223.
- [126] McKendry M, McGloin H, Saberi D, et al. Randomised controlled trial assessing the impact of a nurse delivered, flow monitored protocol for optimisation of circulatory status after cardiac surgery [J]. *BMJ*, 2004, 329(7460):258. DOI:10.1136/bmj.38156.767118.7C.
- [127] Pearse R, Dawson D, Fawcett J, et al. Early goal - directed therapy after major surgery reduces complications and duration of hospital stay. a randomised, controlled trial [ISRCTN38797445] [J]. *Crit Care*, 2005, 9(6):R687-693. DOI:10.1186/cc3887.
- [128] Brandstrup B, Tønnesen H, Beier-Holgersen R, et al. Effects of intravenous fluid restriction on postoperative complications: comparison of two perioperative fluid regimens: a randomized assessor-blinded multicenter trial [J]. *Ann Surg*, 2003, 238(5):641-648. DOI:10.1097/01.sla.0000094387.50865.23.
- [129] Holte K, Foss NB, Andersen J, et al. Liberal or restrictive fluid administration in fast - track colonic surgery: a randomized, double-blind study [J]. *Br J Anaesth*, 2007, 99(4):500-508. DOI:10.1093/bja/aem211.
- [130] Kabon B, Akça O, Taguchi A, et al. Supplemental intravenous crystalloid administration does not reduce the risk of surgical wound infection [J]. *Anesth Analg*, 2005, 101(5):1546-1553. DOI:10.1213/01.ANE.0000180217.57952.FE.
- [131] Lobo DN, Bostock KA, Neal KR, et al. Effect of salt and water balance on recovery of gastrointestinal function after elective colonic resection: a randomised controlled trial [J]. *Lancet*, 2002, 359(9320):1812-1818. DOI:10.1016/S0140-6736(02)08711-1.
- [132] Nisanevich V, Felsenstein I, Almog G, et al. Effect of intraoperative fluid management on outcome after intraabdominal surgery [J]. *Anesthesiology*, 2005, 103(1):25-32.
- [133] Belkin NL. Are "barrier" drapes cost effective? [J]. *Today's Surg Nurse*, 1998, 20(6):18-23.
- [134] Bellchambers J, Harris JM, Cullinan P, et al. A prospective study of wound infection in coronary artery surgery [J]. *Eur J Cardiothorac Surg*, 1999, 15(1):45-50. DOI:10.1016/S1010-7940(98)00255-3.
- [135] Ferrer CM, Alvarez MM, García JR. Comparison of sterile, disposable surgical drapes [J]. *Enferm Clin*, 2004, 14(1):3-6.
- [136] Gallagher MM, Santini L, Magliano G, et al. Feasibility and safety of a simplified draping method for pacing procedures [J]. *Europace*, 2007, 9(10):890-893. DOI:10.1093/europace/

- eum112.
- [137] Treggiari M, Benevento A, Caronno R, et al. [The evaluation of the efficacy of drapes and gowns of nonwoven fabric versus drapes and gowns of cotton in reducing the incidence of postoperative wound infections][J]. *Minerva Chir*, 1992, 47(1-2):49-54.
- [138] Al-Qahtani SM, Al-Amoudi HM, Al-Jehani S, et al. Post-appendectomy surgical site infection rate after using an antimicrobial film incise drape: a prospective study [J]. *Surg Infect (Larchmt)*, 2015, 16(2):155-158. DOI: 10.1089/sur.2013.188.
- [139] Segal C, Anderson J. Preoperative skin preparation of cardiac patients [J]. *AORN J*, 2002, 76(5):821-828. DOI: 10.1016/S0001-2092(06)61035-1.
- [140] Swenson BR, Camp TR, Mulloy DP, et al. Antimicrobial-impregnated surgical incise drapes in the prevention of mesh infection after ventral hernia repair [J]. *Surg Infect (Larchmt)*, 2008, 9(1):23-32. DOI: 10.1089/sur.2007.021.
- [141] Yoshimura Y, Kubo S, Hirohashi K, et al. Plastic iodophor drape during liver surgery operative use of the iodophor-impregnated adhesive drape to prevent wound infection during high risk surgery [J]. *World J Surg*, 2003, 27(6):685-688. DOI: 10.1007/s00268-003-6957-0.
- [142] Baier P, Kiesel M, Kayser C, et al. Ring drape do not protect against surgical site infections in colorectal surgery: a randomised controlled study [J]. *Int J Colorectal Dis*, 2012, 27(9):1223-1228. DOI: 10.1007/s00384-012-1484-9.
- [143] Brunet P, Bounoua F, Bugnon P, et al. Intérêt des champs à anneaux chirurgie abdominale [J]. *Lyon Chir*, 1994, 90(6):438-441.
- [144] Cheng KP, Roslani AC, Sehha N, et al. ALEXIS O-Ring wound retractor vs conventional wound protection for the prevention of surgical site infections in colorectal resections (1) [J]. *Colorectal Dis*, 2012, 14(6):e346-e351. DOI: 10.1111/j.1463-1318.2012.02943.x.
- [145] Horiuchi T, Tanishima H, Tamagawa K, et al. Randomized, controlled investigation of the anti-infective properties of the alexis retractor/protector of incision sites [J]. *J Trauma*, 2007, 62(1):212-215. DOI: 10.1097/01.ta.0000196704.78785.ae.
- [146] Lee P, Waxman K, Taylor B, et al. Use of wound-protection system and postoperative wound-infection rates in open appendectomy: a randomized prospective trial [J]. *Arch Surg*, 2009, 144(9):872-875. DOI: 10.1001/archsurg.2009.151.
- [147] Mihaljevic AL, Schirren R, Özer M, et al. Multicenter double-blinded randomized controlled trial of standard abdominal wound edge protection with surgical dressings versus coverage with a sterile circular polyethylene drape for prevention of surgical site infections: a CHIR-Net trial (BaFO; NCT01181206) [J]. *Ann Surg*, 2014, 260(5):730-739. DOI: 10.1097/SLA.0000000000000954.
- [148] Pinkney TD, Calvert M, Bartlett DC, et al. Impact of wound edge protection devices on surgical site infection after laparotomy: multicentre randomised controlled trial (ROSSINI Trial) [J]. *BMJ*, 2013, 347:f4305. DOI: 10.1136/bmj.f4305.
- [149] Redmond H, Meagher P, Kelly C, et al. Use of an impervious wound-edge protector to reduce the postoperative wound infection rate [J]. *Br J Surg*, 1994, 181(1):81.
- [150] Reid K, Pockney P, Draganic B, et al. Barrier wound protection decreases surgical site infection in open elective colorectal surgery: a randomized clinical trial [J]. *Dis Colon Rectum*, 2010, 53(10):1374-1380. DOI: 10.1007/DCR.0b013e3181ed3f7e.
- [151] Sookhai S, Redmond HP, Deasy JM. Impervious wound-edge protector to reduce postoperative wound infection: a randomised, controlled trial [J]. *Lancet*, 1999, 353(9164):1585. DOI: 10.1016/S0140-6736(99)00950-2.
- [152] Theodoridis TD, Chatzigeorgiou KN, Zepiridis L, et al. A prospective randomized study for evaluation of wound retractors in the prevention of incision site infections after cesarean section [J]. *Clin Exp Obstet Gynecol*, 2011, 38(1):57-59.
- [153] Lau WY, Fan ST, Chu KW, et al. Combined topical povidone-iodine and systemic antibiotics in postappendectomy wound sepsis [J]. *Br J Surg*, 1986, 73(12):958-960. DOI: 10.1002/bjs.1800731205.
- [154] Rogers DM, Blouin GS, O'Leary JP. Povidone-iodine wound irrigation and wound sepsis [J]. *Surg Gynecol Obstet*, 1983, 157(5):426-430.
- [155] Sindelar WF, Brower ST, Merkel AB, et al. Randomised trial of intraperitoneal irrigation with low molecular weight povidone-iodine solution to reduce intra-abdominal infectious complications [J]. *J Hosp Infect*, 1985, 6 Suppl A:103-114.
- [156] Sindelar WF, Mason GR. Irrigation of subcutaneous tissue with povidone-iodine solution for prevention of surgical wound infections [J]. *Surg Gynecol Obstet*, 1979, 148(2):227-231.
- [157] Pitt HA, Postier RG, MacGowan AW, et al. Prophylactic antibiotics in vascular surgery. topical, systemic, or both? [J]. *Ann Surg*, 1980, 192(3):356-364.
- [158] Freischlag J, McGrattan M, Busuttill RW. Topical versus systemic cephalosporin administration in elective biliary operations [J]. *Surgery*, 1984, 96(4):686-693.
- [159] Juul P, Merrild U, Kronborg O. Topical ampicillin in addition to a systemic antibiotic prophylaxis in elective colorectal surgery. a prospective randomized study [J]. *Dis Colon Rectum*, 1985, 28(11):804-806.
- [160] Moesgaard F, Nielsen ML, Hjortrup A, et al. Intra-incisional antibiotic in addition to systemic antibiotic treatment fails to reduce wound infection rates in contaminated abdominal surgery. a controlled clinical trial [J]. *Dis Colon Rectum*, 1989, 32(1):36-38.
- [161] Ruiz-Tovar J, Cansado P, Perez-Soler M, et al. Effect of gentamicin lavage of the axillary surgical bed after lymph node dissection on drainage discharge volume [J]. *Breast*, 2013, 22(5):874-878. DOI: 10.1016/j.breast.2013.03.008.
- [162] Gillespie BM, Rickard CM, Thalib L, et al. Use of negative-

- pressure wound dressings to prevent surgical site complications after primary hip arthroplasty: a pilot RCT [J]. *Surg Innov*, 2015, 22(5):488-495. DOI:10.1177/1553350615573583.
- [163] Howell R, Hadley S, Strauss E, et al. Blister formation with negative pressure dressings after total knee arthroplasty [J]. *Curr Orthop Pract*, 2011, 22(2):176-179. DOI:10.1097/BCO.0b013e31820b3e21.
- [164] Masden D, Goldstein J, Endara M, et al. Negative pressure wound therapy for at-risk surgical closures in patients with multiple comorbidities: a prospective randomized controlled study [J]. *Ann Surg*, 2012, 255(6):1043-1047. DOI:10.1097/SLA.0b013e3182501bae.
- [165] Stannard JP, Robinson JT, Anderson ER, et al. Negative pressure wound therapy to treat hematomas and surgical incisions following high-energy trauma [J]. *J Trauma*, 2006, 60(6):1301-1306. DOI:10.1097/01.ta.0000195996.73186.2e.
- [166] Stannard JP, Volgas DA, McGwin G 3rd, et al. Incisional negative pressure wound therapy after high-risk lower extremity fractures [J]. *J Orthop Trauma*, 2012, 26(1):37-42. DOI:10.1097/BOT.0b013e318216b1e5.
- [167] Adogwa O, Fatemi P, Perez E, et al. Negative pressure wound therapy reduces incidence of postoperative wound infection and dehiscence after long-segment thoracolumbar spinal fusion: a single institutional experience [J]. *Spine J*, 2014, 14(12):2911-2917. DOI:10.1016/j.spinee.2014.04.011.
- [168] Blackham AU, Farrah JP, McCoy TP, et al. Prevention of surgical site infections in high-risk patients with laparotomy incisions using negative-pressure therapy [J]. *Am J Surg*, 2013, 205(6):647-654. DOI:10.1016/j.amjsurg.2012.06.007.
- [169] Bonds AM, Novick TK, Dietert JB, et al. Incisional negative pressure wound therapy significantly reduces surgical site infection in open colorectal surgery [J]. *Dis Colon Rectum*, 2013, 56(12):1403-1408. DOI:10.1097/DCR.0b013e3182a39959.
- [170] Chadi SA, Kidane B, Britto K, et al. Incisional negative pressure wound therapy decreases the frequency of postoperative perineal surgical site infections: a cohort study [J]. *Dis Colon Rectum*, 2014, 57(8):999-1006. DOI:10.1097/DCR.00000000000000161.
- [171] Condé-Green A, Chung T, Holton LH 3rd, et al. Incisional negative-pressure wound therapy versus conventional dressings following abdominal wall reconstruction: a comparative study [J]. *Ann Plast Surg*, 2013, 71(4):394-397. DOI:10.1097/SAP.0b013e31824e9073.
- [172] Gassman A, Mehta A, Buchholdz E, et al. Positive outcomes with negative pressure therapy over primarily closed large abdominal wall reconstruction reduces surgical site infection rates [J]. *Hernia*, 2015, 19(2):273-278. DOI:10.1007/s10029-014-1312-y.
- [173] Grauhan O, Navasardyan A, Hofmann M, et al. Prevention of poststernotomy wound infections in obese patients by negative pressure wound therapy [J]. *J Thorac Cardiovasc Surg*, 2013, 145(5):1387-1392. DOI:10.1016/j.jtcvs.2012.09.040.
- [174] Grauhan O, Navasardyan A, Tutkun B, et al. Effect of surgical incision management on wound infections in a poststernotomy patient population [J]. *Int Wound J*, 2014, 11 Suppl1:6-9. DOI:10.1111/iwj.12294.
- [175] Matatov T, Reddy KN, Doucet LD, et al. Experience with a new negative pressure incision management system in prevention of groin wound infection in vascular surgery patients [J]. *J Vasc Surg*, 2013, 57(3):791-795. DOI:10.1016/j.jvs.2012.09.037.
- [176] Pauli EM, Krpata DM, Novitsky YW, et al. Negative pressure therapy for high-risk abdominal wall reconstruction incisions [J]. *Surg Infect (Larchmt)*, 2013, 14(3):270-274. DOI:10.1089/sur.2012.059.
- [177] Pellino G, Sciaudone G, Candilio G, et al. Preventive NPWT over closed incisions in general surgery: does age matter? [J]. *Int J Surg*, 2014, 12 Suppl 2:S64-S68. DOI:10.1016/j.ijsu.2014.08.378.
- [178] Reddix RN Jr, Leng XI, Woodall J, et al. The effect of incisional negative pressure therapy on wound complications after acetabular fracture surgery [J]. *J Surg Orthop Adv*, 2010, 19(2):91-97.
- [179] Selvaggi F, Pellino G, Sciaudone G, et al. New advances in negative pressure wound therapy (NPWT) for surgical wounds of patients affected with Crohn's disease [J]. *Surg Technol Int*, 2014, 24:83-89.
- [180] Soares KC, Baltodano PA, Hicks CW, et al. Novel wound management system reduction of surgical site morbidity after ventral hernia repairs: a critical analysis [J]. *Am J Surg*, 2015, 209(2):324-332. DOI:10.1016/j.amjsurg.2014.06.022.
- [181] Baracs J, Huszar O, Sajjadi SG, et al. Surgical site infections after abdominal closure in colorectal surgery using triclosan-coated absorbable suture (PDS Plus) vs. uncoated sutures (PDS II): a randomized multicenter study [J]. *Surg Infect (Larchmt)*, 2011, 12(6):483-489. DOI:10.1089/sur.2011.001.
- [182] Diener MK, Knebel P, Kieser M, et al. Effectiveness of triclosan-coated PDS Plus versus uncoated PDS II sutures for prevention of surgical site infection after abdominal wall closure: the randomised controlled PROUD trial [J]. *Lancet*, 2014, 384(9938):142-152. DOI:10.1016/S0140-6736(14)60238-5.
- [183] Ford HR, Jones P, Gaines B, et al. Intraoperative handling and wound healing: controlled clinical trial comparing coated VICRYL plus antibacterial suture (coated polyglactin 910 suture with triclosan) with coated VICRYL suture (coated polyglactin 910 suture) [J]. *Surg Infect (Larchmt)*, 2005, 6(3):313-321. DOI:10.1089/sur.2005.6.313.
- [184] Galal I, El-Hindawy K. Impact of using triclosan-antibacterial sutures on incidence of surgical site infection [J]. *Am J Surg*, 2011, 202(2):133-138. DOI:10.1016/j.amjsurg.2010.06.011.
- [185] Isik I, Selimen D, Senay S, et al. Efficiency of antibacterial suture material in cardiac surgery: a double-blind randomized prospective study [J]. *Heart Surg Forum*, 2012, 15(1):E40-E45. DOI:10.1532/HSF98.20111106.

- [186] Justinger C, Slotta JE, Ningel S, et al. Surgical-site infection after abdominal wall closure with triclosan - impregnated polydioxanone sutures; results of a randomized clinical pathway facilitated trial (NCT00998907) [J]. *Surgery*, 2013, 154(3): 589-595. DOI:10.1016/j.surg.2013.04.011.
- [187] Mingmalairak C, Ungbhakorn P, Paocharoen V. Efficacy of antimicrobial coating suture coated polyglactin 910 with triclosan (Vicryl plus) compared with polyglactin 910 (Vicryl) in reduced surgical site infection of appendicitis, double blind randomized control trial, preliminary safety report [J]. *J Med Assoc Thai*, 2009, 92(6):770-775.
- [188] Nakamura T, Kashimura N, Noji T, et al. Triclosan - coated sutures reduce the incidence of wound infections and the costs after colorectal surgery: a randomized controlled trial [J]. *Surgery*, 2013, 153(4):576-583. DOI:10.1016/j.surg.2012.11. 018.
- [189] Rasić Z, Schwarz D, Adam VN, et al. Efficacy of antimicrobial triclosan-coated polyglactin 910 (Vicryl\* Plus) suture for closure of the abdominal wall after colorectal surgery [J]. *Coll Antropol*, 2011, 35(2):439-443.
- [190] Seim BE, Tønnessen T, Woldbaek PR. Triclosan-coated sutures do not reduce leg wound infections after coronary artery bypass grafting [J]. *Interact Cardiovasc Thorac Surg*, 2012, 15(3):411-415. DOI:10.1093/icvts/ivs266.
- [191] Thimour-Bergström L, Roman-Emanuel C, Scherstén H, et al. Triclosan-coated sutures reduce surgical site infection after open vein harvesting in coronary artery bypass grafting patients: a randomized controlled trial [J]. *Eur J Cardiothorac Surg*, 2013, 44(5): 931-938. DOI:10.1093/ejcts/ezt063.
- [192] Turtiainen J, Saimanen EI, Mäkinen KT, et al. Effect of triclosan - coated sutures on the incidence of surgical wound infection after lower limb revascularization surgery: a randomized controlled trial [J]. *World J Surg*, 2012, 36(10): 2528-2534. DOI:10.1007/s00268-012-1655-4.
- [193] Williams N, Sweetland H, Goyal S, et al. Randomized trial of antimicrobial - coated sutures to prevent surgical site infection after breast cancer surgery [J]. *Surg Infect (Larchmt)*, 2011, 12(6):469-474. DOI:10.1089/sur.2011.045.
- [194] Chen SY, Chen TM, Dai NT, et al. Do antibacterial - coated sutures reduce wound infection in head and neck cancer reconstruction? [J]. *Eur J Surg Oncol*, 2011, 37(4): 300-304. DOI:10.1016/j.ejso.2011.01.015.
- [195] Hoshino S, Yoshida Y, Tanimura S, et al. A study of the efficacy of antibacterial sutures for surgical site infection: a retrospective controlled trial [J]. *Int Surg*, 98(2):129-132. DOI: 10.9738/CC179.
- [196] Laas E, Poilroux C, Bézu C, et al. Antibacterial-coated suture in reducing surgical site infection in breast surgery: a prospective study [J]. *Int J Breast Cancer*, 2012, 2012:819578. DOI:10.1155/2012/819578.
- [197] Okada N, Nakamura T, Ambo Y, et al. Triclosan - coated abdominal closure sutures reduce the incidence of surgical site infections after pancreaticoduodenectomy [J]. *Surg Infect (Larchmt)*, 2014, 15(3):305-309. DOI:10.1089/sur.2012.170.
- [198] Ueno M, Saito W, Yamagata M, et al. Triclosan-coated sutures reduce wound infections after spinal surgery: a retrospective, nonrandomized, clinical study [J]. *Spine J*, 2015, 15(5):933-938. DOI:10.1016/j.spinee.2013.06.046.
- [199] Becker A, Koltun L, Sayfan J. Impact of antimicrobial prophylaxis duration on wound infection in mesh repair of incisional hernia - preliminary results of a prospective randomized trial [J]. *Eur Surg*, 2008, 40(1):37-40. DOI:10.1007/s10353-008-0383-3.
- [200] Hall JC, Christiansen KJ, Goodman M, et al. Duration of antimicrobial prophylaxis in vascular surgery [J]. *Am J Surg*, 1998, 175(2):87-90. DOI:10.1016/S0002-9610(97)00270-5.
- [201] Mohri Y, Tonouchi H, Kobayashi M, et al. Randomized clinical trial of single- versus multiple-dose antimicrobial prophylaxis in gastric cancer surgery [J]. *Br J Surg*, 2007, 94(6):683-688. DOI: 10.1002/bjs.5837.
- [202] Orlando G, Manzia TM, Sorge R, et al. One - shot versus multidose perioperative antibiotic prophylaxis after kidney transplantation: a randomized, controlled clinical trial [J]. *Surgery*, 2015, 157(1):104-110. DOI:10.1016/j.surg.2014.06. 007.
- [203] Oxman DA, Issa NC, Marty FM, et al. Postoperative antibacterial prophylaxis for the prevention of infectious complications associated with tube thoracostomy in patients undergoing elective general thoracic surgery: a double - blind, placebo - controlled, randomized trial [J]. *JAMA Surg*, 2013, 148(5):440-446. DOI:10.1001/jamasurg.2013.1372.
- [204] Seker D, Ugurlu C, Ergul Z, et al. Single dose prophylactic antibiotics may not be sufficient in elective pilonidal sinus surgery: an early terminated study [J]. *Turkiye Klinikleri Journal of Medical Sciences*, 2011, 31(1):186-190.
- [205] Suzuki T, Sadahiro S, Maeda Y, et al. Optimal duration of prophylactic antibiotic administration for elective colon cancer surgery: a randomized, clinical trial [J]. *Surgery*, 2011, 149(2): 171-178. DOI:10.1016/j.surg.2010.06.007.
- [206] Ackroyd R, Reed MWR. A prospective randomized trial of the management of suction drains following breast cancer surgery with axillary clearance [J]. *Breast*, 1997, 6(5):271-274. DOI: 10.1016/S0960-9776(97)90003-5.
- [207] Baas-Vrancken Peeters MJ, Kluit AB, Merkus JW, et al. Short versus long-term postoperative drainage of the axilla after axillary lymph node dissection. a prospective randomized study [J]. *Breast Cancer Res Treat*, 2005, 93(3):271-275. DOI:10.1007/s10549-005-5348-7.
- [208] Barton A, Blitz M, Callahan D, et al. Early removal of postmastectomy drains is not beneficial; results from a halted randomized controlled trial [J]. *Am J Surg*, 2006, 191(5):652-656. DOI:10.1016/j.amjsurg.2006.01.037.
- [209] Clegg-Lampsey JN, Dakubo JC, Hodasi WM. Comparison of four-day and ten-day post-mastectomy passive drainage in Accra, Ghana [J]. *East Afr Med J*, 2007, 84(12):561-565.

- [210] Dalberg K, Johansson H, Signomklao T, et al. A randomised study of axillary drainage and pectoral fascia preservation after mastectomy for breast cancer[J]. *Eur J Surg Oncol*, 2004,30(6): 602-609. DOI:10.1016/j.ejso.2004.03.020.
- [211] Gupta R, Pate K, Varshney S, et al. A comparison of 5-day and 8-day drainage following mastectomy and axillary clearance[J]. *Eur J Surg Oncol*, 2001,27(1):26-30. DOI:10.1053/ejso.2000.1054.
- [212] Inwang R, Hamed H, Chaudary MA, et al. A controlled trial of short-term versus standard axillary drainage after axillary clearance and iridium implant treatment of early breast cancer [J]. *Ann R Coll Surg Engl*, 1991,73(5):326-328.
- [213] Kopelman D, Klemm O, Bahous H, et al. Postoperative suction drainage of the axilla: for how long? prospective randomised trial [J]. *Eur J Surg*, 1999,165(2):117-122. DOI:10.1080/110241599750007289.
- [214] Parikh HK, Badwe RA, Ash CM, et al. Early drain removal following modified radical mastectomy: a randomized trial [J]. *J Surg Oncol*, 1992,51(4):266-269.
- [215] Strahovnik A, Fokter SK, Kotnik M. Comparison of drainage techniques on prolonged serous drainage after total hip arthroplasty [J]. *J Arthroplasty*, 2010,25(2):244-248. DOI:10.1016/j.arth.2008.08.014.
- [216] Zamora-Navas P, Collado-Torres F, de la Torre-Solís F. Closed suction drainage after knee arthroplasty. a prospective study of the effectiveness of the operation and of bacterial contamination [J]. *Acta Orthop Belg*, 1999,65(1):44-47.
- [217] Biffi R, Fattori L, Bertani E, et al. Surgical site infections following colorectal cancer surgery: a randomized prospective trial comparing common and advanced antimicrobial dressing containing ionic silver [J]. *World J Surg Oncol*, 2012,10:94. DOI:10.1186/1477-7819-10-94.
- [218] Burke NG, Green C, McHugh G, et al. A prospective randomised study comparing the jubilee dressing method to a standard adhesive dressing for total hip and knee replacements [J]. *J Tissue Viability*, 2012,21(3):84-87. DOI:10.1016/j.jtv.2012.04.002.
- [219] Dickinson JC, Culver CR, Baker JW. A prospective, randomized controlled trial comparing 3 dressing types following sternotomy[J]. *Ostomy Wound Manage*, 2015,61(5):42-49.
- [220] Krieger BR, Davis DM, Sanchez JE, et al. The use of silver nylon in preventing surgical site infections following colon and rectal surgery [J]. *Dis Colon Rectum*, 2011,54(8):1014-1019. DOI:10.1097/DCR.0b013e31821c495d.
- [221] Martín-Trapero C, Martín-Torrijos M, Fernández-Conde L, et al. [Surgical site infections. effectiveness of polyhexamethylene biguanide wound dressings][J]. *Enferm Clin*, 2013,23(2):56-61. DOI:10.1016/j.enfcli.2013.01.005.
- [222] Michie DD, Hugill JV. Influence of occlusive and impregnated gauze dressings on incisional healing: a prospective, randomized, controlled study [J]. *Ann Plast Surg*, 1994,32(1):57-64.
- [223] Ozaki CK, Hamdan AD, Barshes NR, et al. Prospective, randomized, multi-institutional clinical trial of a silver alginate dressing to reduce lower extremity vascular surgery wound complications [J]. *J Vasc Surg*, 2015,61(2):419-427.e1. DOI:10.1016/j.jvs.2014.07.034.
- [224] Shinohara T, Yamashita Y, Satoh K, et al. Prospective evaluation of occlusive hydrocolloid dressing versus conventional gauze dressing regarding the healing effect after abdominal operations: randomized controlled trial [J]. *Asian J Surg*, 2008,31(1):1-5. DOI:10.1016/S1015-9584(08)60046-9.
- [225] Vogt KC, Uhlyarik M, Schroeder TV. Moist wound healing compared with standard care of treatment of primary closed vascular surgical wounds: a prospective randomized controlled study [J]. *Wound Repair Regen*, 2007,15(5):624-627. DOI:10.1111/j.1524-475X.2007.00294.x.
- [226] Wynne R, Botti M, Stedman H, et al. Effect of three wound dressings on infection, healing comfort, and cost in patients with sternotomy wounds: a randomized trial [J]. *Chest*, 2004,125(1):43-49.

(收稿日期:2019-02-25)

(本文编辑:卜建红)

## ·读者·作者·编者·

## 本刊“胃肠新视野”栏目征稿启事

“胃肠新视野”栏目为本刊特设的视频栏目。视频内容通过“e-Surgery 伊索云®/医路有伴®平台”为我刊设置的“专区”呈现,大家可通过手机进行观看。同时,视频内容的相关文字内容(包括手术方式的介绍、新技术的创新背景、病例介绍、手术相关并发症的处理要点等)会在相应的杂志上刊登并附二维码。诚挚欢迎各位同道积极投稿,具体投稿要求如下。

1. 内容:主要为手术视频,侧重展示胃肠新技术、新术式以及术中并发症的处理等;并附相应的文字介绍(1000字左右)。

2. 视频:视频时长不超过9 min,视频附带解说,大小<350 MB,格式:MPEG、MOV、MP4、AVI或WMV。请注明解剖部位;无背景音乐,避免“花俏”转场。已发行的具有著作权的视频资料DVD不宜。

3. 本栏目的视频及文字内容请发至我刊Email:china\_gisj@vip.163.com。

本刊编辑部