·综述·

老年创伤患者围术期反流误吸相关影响因素研究进展

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【摘要】 老年创伤患者因生理功能退行性改变叠加创伤应激反应，围术期反流误吸发生概率显著升高，已成为麻醉管理的重要问题。本综述系统梳理国内外研究，从定义、诊断、影响因素、风险评估及预防策略展开分析。围术期反流误吸指患者在全身麻醉诱导、术中及术后发生胃内容物反流并吸入下呼吸道，可引发化学性肺炎、呼吸窘迫综合征等严重并发症。临床诊断需结合直接观察与排他法，借助胸部计算机断层扫描（CT）、支气管镜、核素显像及生物学标志物检测实现精准判断。老年创伤患者围术期反流误吸的影响因素呈多维度特征。患者自身因素包括美国麻醉医师协会（ASA）分级高、合并帕金森病、脑卒中、慢性阻塞性肺疾病（COPD）、糖尿病等基础疾病，胃肠道蠕动减慢、胃排空延迟，以及吸烟、肥胖等。手术相关因素涉及急诊手术禁食禁饮时间不足、上腹部手术等致腹内压增高的术式，以及胰高血糖素样肽-1（GLP-1）受体激动剂等影响胃排空的药物。围术期麻醉管理是核心独立影响因素。临床风险评估手段包括术前病史采集、床旁超声评估胃内容物等。结合加速康复外科（ERAS）多学科管理理念，防控策略如下：术前细致评估高危因素，合理缩短禁食禁饮时间并给予清饮或碳水化合物液体，联合使用抗酸剂、促动力药等药物；麻醉诱导采用改良快速顺序插管，术中规范气道管理；一旦发生反流误吸，立即采取体位调整、气道吸引、纯氧通气等急救措施，必要时行支气管镜灌洗及体外膜肺氧合（ECMO）支持。对老年创伤患者围术期反流误吸需实施术前精准评估、术中规范管理、术后及时干预的全流程防控，通过多学科协作落实ERAS策略，可有效降低风险，提升患者围术期安全性，为临床制定预防措施提供重要参考。

【关键词】 老年； 创伤患者； 围术期； 反流误吸； 加速康复外科

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Research progress on perioperative reflux and aspiration in elderly trauma patients

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【Abstract】 Elderly trauma patients have a significantly increased probability of perioperative reflux and aspiration due to degenerative changes in physiological function combined with post-traumatic stress response, which has become an important issue in anesthesia management. This review systematically summarizes domestic and international research, analyzing the definition, diagnosis, influencing factors, risk assessment, and preventive strategies. Perioperative reflux and aspiration refer to the occurrence of gastric contents refluxing and being inhaled into the lower respiratory tract during general anesthesia induction, intraoperatively, or postoperatively, which can lead to severe complications such as chemical pneumonia and respiratory distress syndrome. Clinical diagnosis requires a combination of direct observation and exclusion methods, utilizing chest computed tomography (CT), bronchoscopy, radionuclide imaging, and biomarker detection to achieve precise judgment. The influencing factors for perioperative reflux and aspiration in elderly trauma patients are multidimensional. Patient-related factors include high American Society of Anesthesiologists (ASA) classification, comorbidities such as Parkinson's disease, stroke, chronic obstructive pulmonary disease (COPD), diabetes mellitus, slowed gastrointestinal motility, delayed gastric emptying, as well as smoking and obesity. Surgery-related factors involve insufficient fasting time for emergency surgery, surgical procedures that increase intra-abdominal pressure such as upper abdominal surgery, and the use of medications affecting gastric emptying such as glucagon-like peptide-1 (GLP-1) receptor agonists. Perioperative anesthesia management is a core independent influencing factor. Clinical risk assessment methods include preoperative medical history collection and bedside ultrasound evaluation of gastric contents. In line with the multidisciplinary management concept of enhanced recovery after surgery (ERAS), the prevention and control strategies are as follows: preoperative meticulous assessment of risk factors, appropriate shortening of fasting time with administration of clear fluids or carbohydrate liquids, combined use of medications such as antacids and prokinetic agents; modified rapid sequence intubation for anesthesia induction, standardized airway management intraoperatively; in the event of reflux and aspiration, immediate implementation of emergency measures such as positioning, airway suctioning, and oxygenation with 100% oxygen, with bronchoscopic lavage and extracorporeal

membrane oxygenation (ECMO) support if necessary. For elderly trauma patients, perioperative reflux and aspiration require a full-process approach encompassing precise preoperative evaluation, standardized intraoperative management, and timely postoperative intervention. Implementing ERAS strategies through multidisciplinary collaboration can effectively reduce risks, enhance perioperative safety for patients, and provide important references for developing safe and feasible clinical preventive measures.

【Key words】 Elderly; Trauma patient; Perioperative; Reflux and aspiration; Enhanced recovery after surgery
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近年来围术期反流误吸逐渐引起临床重视，国内外相关指南共识也陆续出台。因老年患者常合并多种慢性病，加之生理退行性变，当受到创伤后会启动一系列应激反应，胃排空时间延长，致使围术期反流误吸发生率较高。现将老年创伤患者围术期反流误吸的临床研究结果综述如下。

1　围术期反流误吸的定义及诊断

1.1　定义：患者在接受全身麻醉诱导、术中、术后发生胃内容物反流后，吸入下呼吸道，被称为围术期反流误吸[1]。吸入物质刺激上皮细胞和肺泡巨噬细胞分泌化学介质，吸引并激活中性粒细胞，释放蛋白酶和活性氧，降解肺泡毛细血管单位，导致一系列生理病理学变化，如感染性肺炎、化学性肺炎或呼吸窘迫综合征等，病死率高[2]。围术期反流误吸是一种罕见但可危及生命的麻醉相关并发症，误吸在美国麻醉医师协会（American Society of Anesthesiologists, ASA）分级中分为Ⅰ级和Ⅱ级，健康患者中发生率不高，成人约为1.1/1万，儿童约为1.3/1万[3]。反流误吸一旦发生可能导致肺炎、呼吸功能不全、休克等严重症状，总病死率达到0.0014%[4]。老年患者因食管括约肌松弛，咽喉部直觉减退及所患疾病等因素，围术期发生反流误吸的概率增大[5]。因此，老年患者围术期应充分考虑易导致反流误吸的危险因素，并制定合适的麻醉方案避免其发生。

1.2　围术期反流误吸的诊断：围手术期反流误吸常发生在接受全身麻醉患者的麻醉诱导过程中[6]。多数可直接观察到胃内容物反流到口咽部，随后被吸入呼吸道，即可确诊为反流误吸。而发生在麻醉维持阶段、麻醉苏醒时及拔管后的反流误吸不易察觉，与患者术后低氧血症相关，较难进行明确诊断。未能直接观察到的围术期反流误吸，通常采用排他法，排除缺氧等其他病因，如肺水肿、肺栓塞、社区或医院获得性细菌性肺炎等情况外的低氧血症[7]。吸入性肺炎临床诊断依据是不能解释的低氧血症与胸部计算机断层扫描（computed tomography, CT）提示肺内浸润表现相结合。其中胸部浸润影常累及肺部的下垂部分，严重程度取决于患者发生误吸时的体位[7]。仰卧位误吸患者CT典型特征是中肺野浸润，包括上肺叶后段和下肺叶顶端段；而直立位误吸常会导致患者肺基底段浸润，但并非所有误吸都能在CT上观察到浸润表现[8]。以下几种方法可辅助诊断胃食管反流，包括咽喉镜检查，发现喉部水肿红斑，提示可能发生胃内容物反流；支气管镜检查，通过支气管肺泡灌洗液（bronchoalveolar lavage fluid, BALF），灌洗液中含有胃蛋白酶[9]、含脂质的巨噬细胞[10-11]、淀粉酶[12]、可溶性髓样细胞触发受体-1（soluble triggering receptor expressed on myeloid cells-1, sTREM-1）[13]、叶绿素染色的巨噬细胞[14]等生物学特异标志物；核素显像（胃-肺闪烁扫描）。一项临床研究纳入361例患者，按症状特征分为喉咽反流（laryngopharyngeal reflux, LPR）或胃食管反流（gastroesophageal reflux disease, GERD），其中263例LPR和98例GERD，分析其症状、pH值、食管测压、闪烁显像及相关性，结果显示，在食物和饮用液体中加入放射性核素后，用γ相机扫描胸腹部，放射性物质若出现在肺部即可诊断[15]。另外，声门下滞留物pH值测定对于诊断酸性反流误吸也有一定特异性[16]。

2　围术期反流误吸患者相关影响因素

2.1　患者自身相关因素：老年患者随年龄增长会发生生理学的改变[17]，包括ASA分级随年龄增长有逐渐升高趋势；老年肥胖患者食道下括约肌松弛，腹内压增高；意识状态欠佳，多巴胺代谢受损等[18]。一项临床研究对64例特发性帕金森病（idiopathic Parkinson's disease, IPD）患者和80例年龄匹配对照组门诊患者进行随访，依据改良芝加哥康复研究所吞咽困难评定量表和一种新评定量表进行吞咽困难评级发现：帕金森患者较普通人群有更高概率的吞咽困难[19]，其反流误吸风险增加[20]。脑梗死后认知损害或癫痫[21]等疾病均可影响吞咽功能，易致吸入性肺炎；老年患者胃肠道蠕动减慢[22]，合并糖尿病[23]、慢性肾病、神经肌肉疾病均可致胃排空延迟[24]，反流误吸风险增高。呼吸系统因素包括长期吸烟[25]、慢性阻塞性肺疾病（chronic obstructive

pulmonary disease, COPD)、抗胆碱能和抗组胺药的使用等,致呛咳反射功能减弱,与吸烟相关的咽喉敏感性降低、气道炎症、呼吸和吞咽模式不协调(吞咽过程中出现吸气),发生误吸,出现呼吸急促或致高碳酸血症,进一步抑制气道保护性反射,吞咽过程中声门下压力改变,致咽部残留物增多等。另外,与过度换气相关的COPD也可致吞咽持续时间延长与吞咽后吸气模式[26]。Cvejic等[27]对16例COPD患者进行病例对照研究,在监测呼吸的同时,通过下颌视频透视进行评估,结果显示,COPD患者在吞咽100 mL液体时易发生渗入喉部/气道,误吸比例为37.5%(6/16),仅有2例患者无误吸性渗透;COPD患者更易出现吸气-吞咽-呼气模式和较大吞咽动作,误吸与呼吸急促、舌骨抬高降低、吞咽后咽部残留及36个月内住院率和病死率增加趋势有关。另外,老年创伤患者常因创伤后卧床及应激反应致肠蠕动减慢、胃排空延迟[1]。以上老年创伤患者生理病理学改变均是其围术期反流误吸高发的相关影响因素。

2.2 手术相关因素:老年患者手术时机是围术期反流误吸的影响因素,包括术前准备是否充分,急诊患者因病情紧急、术前禁食禁饮时间不足、胃内容物较多,反流误吸发生率高于择期手术患者[6]。其次也与手术类型相关,接受减肥手术、上腹部手术、腹腔镜手术、碎石术或俯卧位手术患者,由于腹内压增高促使残余胃内容物反流[28]。患者用药情况亦会影响术前胃排空,在一项涵盖18项临床研究,涉及165 522例患者及3 831例胃内容物残留患者的荟萃分析显示,尽管术前禁食水,但使用胰高血糖素样肽-1(glucagon-like peptide-1, GLP-1)受体激动剂患者与胃内容物残留风险增加相关[29],使用GLP-1受体激动剂会明显延长胃排空时间,导致胃内容物增加,但并未提示与围术期误吸风险直接相关[29-30]。司美格鲁肽是一种治疗2型糖尿病和减肥的辅助用药,有病例报告显示,司美格鲁肽可延迟胃排空,有增大误吸的风险[31-33]。

2.3 围术期麻醉管理相关因素:尽管误吸与患者自身情况、手术方式有一定相关性,但发生围术期误吸的独立影响因素是全麻诱导时的麻醉操作[34]。在患者接受全身麻醉诱导过程中,随着麻醉镇静镇痛药物、肌肉松弛剂的起效,患者自主呼吸逐渐减弱,到完全没有自主呼吸,通过麻醉医生手控辅助通气,以维持身体所需氧合。此时如患者处于饱胃、食道下括约肌松弛或受损,或麻醉深度欠佳,胃内容物会因呛咳反流至口腔,又会因麻醉医生手控呼吸,将胃内容物挤压进气道;或当喉镜放入口腔,准备行气管插管时,咽部刺激亦会引起呛咳,导致胃内压力骤升,胃内容物反流,发生误吸。以上因素包括饱胃、胃排空延迟、食道下括约肌功能障碍、麻醉深度欠佳、手控呼吸等致反流物进入呼吸系统,而致吸入性肺炎[24]。因此,全身麻醉后机械通气是反流误吸的独立影响因素[34]。在进行术中气道管理时,声门上装置如口咽通气道、喉罩,喉管等置入过深,侵入下咽部,刺激食管上括约肌,或多次尝试气管插管、浅麻醉下口腔内更换气管插管等,都会增加误吸反流的风险[28]。尽管人们认为使用喉罩会增加反流误吸发生率,但并未在临床回顾性研究中证实。使用喉罩与气管插管的误吸患者差异无统计学意义,也有研究指出,使用喉罩患者多为择期手术,急诊手术多使用气管插管,急诊手术患者的反流误吸风险较高[35-36]。另外,在保留自主呼吸患者无插管状态下的镇静麻醉中(如消化内镜的舒适化诊疗),反流误吸事件时有报告。一篇发表于《英国麻醉学杂志》关于镇静期间肺误吸的综述性文章显示,在检索到的1 249条研究记录中,有35篇文献详细描述了在程序性镇静期间发生的1次或多次误吸事件,其中在胃肠内镜检查期间共发生292例误吸,且有8例患者因误吸而死亡。尽管需要警惕反流误吸的发生,但临床研究并未证实镇静下患者诊疗是误吸发生的高概率事件[37]。

3 围术期反流误吸风险评估工具及预防策略

加速康复外科(enhanced recovery after surgery, ERAS)是一种多模式、跨学科的围术期管理策略,以加速患者术后康复为目的,在老年创伤患者中尤为重要。在ERAS策略中,缩短术前禁食水时间可明显改善患者主观感受及术后转归,但医护人员对围术期反流误吸的担忧及术前2 h(除第一台手术外)不宜把控,致使缩短术前禁食水的建议在临床上难以实施[24]。老年患者创伤后交感神经兴奋,释放大量儿茶酚胺(如肾上腺素、去甲肾上腺素),疼痛刺激等应激状态均影响胃排空时间。另外,可能存在的低血容量,焦虑情绪,代谢紊乱,合并糖尿病、阿尔茨海默病、脑卒中等疾病都是老年创伤患者反流误吸的高危因素,需进行细致的术前评估、术中管理,以实现ERAS策略加快康复。

麻醉科医生术前应仔细询问病史,评估患者是

否存在反流误吸的危险因素，并指导其严格执行术前禁食禁饮规定，同时关注创伤、疼痛及心理应激等因素对胃排空的影响。建议术前使用抗酸剂（如柠檬酸钠）、组胺 2 型受体拮抗剂、质子泵抑制剂、促动力药、止吐药和抗胆碱能药物等进行术前预防[1]；麻醉诱导时行改良快速顺序诱导插管[1]，严密监测生命体征。一项研究纳入了 126 例拟行择期手术的全麻患者，旨在评估术前饮水对胃内容物的影响，患者被分为常规禁食组和术前饮水组，所有患者术前 2 h 均口服 10 mL 含 50 mg 酚红的水溶液作为标记物，随后，饮水组患者在术前额外饮用 300 mL 清水，麻醉气管插管后，通过多孔 Salem 胃管抽吸胃内容物，并记录胃液总量、pH 值及酚红浓度，结果显示，空腹组与液体组胃液容量、pH 值、苯酚红比较差异无统计学意义[38]。另一项研究纳入了 150 例 ASA 分级Ⅰ/Ⅱ级的择期手术患者，旨在评估术前用药对胃内容物的影响，患者被分为 3 组：术前 1 h 肌注吗啡（0.15 mg/kg）联合异丙嗪（0.5 mg/kg）麻醉诱导后药物干预组、常规禁食组及术前 2 h 口服清水 150 mL 组，结果显示，与后两组相比，麻醉诱导后药物干预组患者的残余胃体积更小，胃液 pH 值更高[39]。多项临床研究均显示，健康患者在麻醉诱导前 2 h 摄入透明液体（＜400 mL）是安全的，且长时间禁饮并未降低误吸风险，保守的术前禁饮标准会引起患者不适[40]，误吸风险并未降低[41]；而应适当缩短术前禁食禁饮时间，并进行静脉补液，能缓解口渴和饥饿，促进胃肠功能恢复，缓解术前焦虑、术后疼痛和降低不良反应发生率[42-43]。因此，依据 ERAS 策略建议在术前 2 h 使用清饮，更推荐术前给予含有简单或复杂碳水化合物的液体（＜400 mL），可减少患者饥饿感[3,43]，改善胰岛素抵抗[44]。

临床医生对于患者尤其老年创伤患者术前 2 h 饮用清饮的态度如何呢？印度一项调查显示，只有 20% 医生遵循 ASA 术前禁食禁饮指南。全球调查也显示，不到 50% 的麻醉科医生会建议患者在术前 2 h 可饮用清饮，可能与手术排程的不确定性、开始麻醉的确切时间常会变化有关。约 12%～16% 的手术会被临时取消，缘于急诊、预计手术时间延长、术前准备不足等原因[24]。也有研究表明，术前静脉输注 5% 葡萄糖溶液可改善患者饥饿口渴，加快术后康复[45]。关于术前咀嚼口香糖能否缓解患者不适感，目前仍存在争议，有研究显示，尽管咀嚼口香糖对患者胃内容物的影响有统计学意义，但其是否能真正降低围术期反流误吸的风险，尚缺乏明确的临床意义[46-47]。

另外，麻醉过程中患者胃内容物含量直接影响反流误吸的发生，术前亦可通过床旁超声评估胃内容物含量，并可观察到胃内容物性质（如透明液体、黏稠液体或固体等）可有效预防反流误吸的发生[48]。应用指征、图像获取、图像解读、医疗决策（indication, acquisition, interpretation, medical decision-making, I-AIM）框架是指导临床实践的适当范式，当胃内容物未知或不确定时，可采用标准化方式获得胃超声图像，根据图像定性和定量评估指导医疗决策[49-50]。

围术期一旦发生反流误吸，应立即调整患者体位，采用头高脚低位；同时快速吸引口咽部反流物后进行气管插管，保护气道，维持氧合。务必纯氧通气，联合呼吸末正压（positive end-expiratory pressure, PEEP）通气方式，尽快清除口腔内及气管内误吸物，在保证氧合的前提下，进行支气管镜检查并清除气管内误吸物[1]，后续给予抗菌药物及类固醇治疗，体外膜肺氧合（extracorporeal membrane oxygenation, ECMO）支持可作为顽固性低氧血症的最终治疗手段[1]。

综上所述，老年创伤患者围术期反流误吸相关影响因素包括患者生理病理学特点、手术相关因素、围术期麻醉管理等。术前应仔细评估，精准预防及管理，应用多学科 ERAS 策略可降低风险，提升老年创伤患者围术期安全。

利益冲突 所有作者均声明不存在利益冲突

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