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胃内容物的评估方法

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摘　要

胃内容物的肺误吸是麻醉中最可怕的并发症之一，有很高的致病率和致死率，所以胃内容物的术前评估成为麻醉过程中必不可少的环节。自主功能测试、禁食指南、鼻胃管或胃镜吸引、影像学检查对胃内容物的评估都有一定帮助，且各有优缺点。其中，胃超声在评估胃内容物上具有很大的优势，被越来越多地应用于临床。

关键词

肺误吸，风险因素，胃内容物的评估方法

Assessment Method of the Gastric Contents

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Abstract

Pulmonary aspiration of gastric contents is one of the most terrible complications in anesthesia, with significant morbidity and mortality, so the preoperative evaluation of gastric contents becomes an essential link in the anesthesia process. Autonomic function tests, fasting guidelines, nasogastric tube or gastroscope attraction, and imaging examination are all helpful in the assessment of gastric contents, each with their own advantages and disadvantages. Among them, gastric ultrasound has great advantages in the evaluation of gastric contents and is increasingly used in clinical practice.

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Keywords

Pulmonary Aspiration, Risk Factors, Assessment Method of the Gastric Contents

1. 引言

胃内容物的肺误吸是呼吸并发症导致的死亡或脑损伤的一个突出原因，严重的误吸不仅可引起呼吸道梗阻导致急性缺氧，更有甚者可导致吸入性肺炎、肺不张，发生不可逆的低氧血症甚至死亡，据调查麻醉期间因误吸导致的死亡率约为5%，占所有麻醉相关死亡率病例的9% [1]，是麻醉中最可怕的并发症之一，因为麻醉过程中，患者食管下括约肌和上呼吸道保护性反射减弱甚或消失[2] [3]，如果发生胃内容物反流，则更容易导致误吸。所以，胃内容物的术前评估成为麻醉过程中必不可少的环节。

围术期增加反流和肺误吸的风险因素可能有以下几个方面[4]-[17]：

1) 胃内容物增加：可能由胃排空延迟(糖尿病、HIV、肾功能衰竭、重度抑郁等引起)、胃液分泌过多、过度进食、禁食时间不足等原因引起。

2) 反流倾向增加：食管下括约肌张力降低、胃食管反流、食管癌或食管狭窄、Zenker 憩室、贲门失弛缓症、年龄等因素。

3) 喉功能不全：拟行全身麻醉的夜间急诊手术、麻醉医生经验不足、头部受伤、脑梗塞或脑出血、神经肌肉疾病(多发性硬化症、帕金森、吉兰巴雷综合征)、脑瘫、颅神经病变、烧伤外伤引起的肌营养不良症等。

临床上为了避免胃内容物的反流误吸，麻醉医生需要更好地评估患者的胃部情况，并制定相应的麻醉方案，胃内容物的评估方法具体如下。

2. 自主功能测试(AFTs)

糖尿病自主神经病变(DAN)继发的胃排空延迟是吸入性肺炎的公认危险因素。使用五次标准化心血管反射测试来评估自主系统功能，测试方法包括：心率对站立的反应、动脉血压对站立的反应、深呼吸时 R-R 间隔变化、Valsalva 动作、动脉血压对握力的反应，如果患者对五项测试中的三项或更多项有异常反应，则被归类为 DAN 阳性。研究表明通过 AFTs 诊断的 DAN 可以预测禁食 8 小时后的胃内容物存在固体食物颗粒，并不能预测胃液量的体积或 pH 值[5]。此法用于合并糖尿病且 DAN 为阳性的患者，操作过程需要患者的理解与配合，不适用于意识混乱、有神经精神障碍等不配合的患者。

3. 禁食指南评估

有关研究表明，胃内容的误吸所导致的肺部结果与吸入胃内容物的性质、体积、酸度、及所含病原体是相关的[15] [16] [17]。固体颗粒性胃内容物的误吸可能造成急性气道阻塞，从而导致动脉低氧血症以致死亡；不同体积、pH 值的胃内容物误吸入肺所造成的肺损伤严重程度是不同的，对肺部的影响可能发生在两个阶段：立即发生的直接组织损伤和随后的炎症反应，若无菌的胃内容物误吸入肺在早期主要表现为肺部的化学性炎症反应[15]。而胃内容物从口咽部携带的定植菌进入呼吸道内，可直接侵袭气管及肺

组织，从而导致感染性肺炎[15] [16] [17]。

ASA 提出的禁食指南旨在减少胃内容物的体积和酸度，从而限制误吸的风险及其相关的发病率和死亡率。对于需要全身麻醉，区域麻醉或程序化镇静和镇痛的手术，透明液体可以在术前摄入长达 2 小时，这些液体不包括酒精；术前摄入母乳长达 4 小时；婴儿配方奶粉术前摄入长达 6 小时；摄入便餐或非人乳长达 6 小时；如果患者摄入油炸食品、高脂肪食物或肉类，则可能需要 8 小时或更长的禁食时间。对于术前肺误吸风险增加的患者，可给予胃肠道兴奋剂、阻断胃酸分泌的药物、非颗粒性抗酸剂；对于术后恶心和呕吐风险增加的患者，可在术前给予止吐药；对于没有明显肺误吸风险增加的患者，不推荐术前常规给予上述药物及抗胆碱能药物来降低肺误吸的风险[18]。

该指南评估胃内容物简单易行，是临床上最常见的评估方法。但是它仅适用于择期手术的健康患者，对于存在胃食管反流病、吞咽困难症状、其他胃肠道蠕动和影响胃排空疾病的患者和紧急情况下可能不可靠[18] [19]。而且禁食指南只能主观上判断胃内容物的有无，对于胃内容物的实际存在情况是不清楚的。另外相关研究也表明尽管在推荐的禁食时间内仍有一小部分(6.2%)择期手术患者可能出现饱腹(胃内容为固体或胃液量 > 1.5 ml/kg) [20]。因此术前完全依靠禁食指南来判断患者是否空腹是不可靠的。

4. 鼻胃管、胃镜吸引评估

4.1. 鼻胃管

临床上放置鼻胃管一般用于远端梗阻的情况下对胃减压，给药或胃内营养，鉴别大量便血是否源于上消化道[21]。对于一些急诊手术，且不清楚术前禁食禁饮情况的病人，为防止围术期的返流误吸风险，也可于术前安置鼻胃管引流。安置鼻胃管后按摩患者的上腹部并在不同的体位进行吸引，尽可能吸出所有胃内容物[22]，通过此法还可以测量胃内容的容量。

使用鼻胃管吸引胃内容物，此方法较简单，可直接观察到吸出物的容量、性状、颜色；因其将胃内容物吸出，一定程度上还可减少反流误吸的风险。

但是放置鼻胃管时患者常感不适，操作过程可能对鼻、消化道等组织造成损伤。鼻胃管对胃内容物的吸取是有局限性的，对于大颗粒的固体胃内容物可能无法完全引流。而且安置鼻胃管以后，食管上下括约肌解剖完整性丧失、食管下括约肌短暂松弛的频率增加、咽喉部反射脱敏[23]，这可能导致麻醉期间胃内容物的反流误吸风险增加。

4.2. 胃镜

胃镜在临床上的使用主要用于疾病诊治、病理活检、异物取出等，Anahi Perlas 提出麻醉后使用胃镜来观察胃内容物，并认为胃镜对胃内容的直视下评估是最精确的方法[24]。

胃镜检查能够更加直观清晰地评估胃内容物，对于拟行胃镜检查、禁食禁饮时间不足疑似饱胃者，直接行清醒胃镜检查评估无疑是最合适不过的。而且可根据评估结果决定后续麻醉方案，为患者保障生命安全的同时提高患者的检查舒适度。

胃镜检查与放置鼻胃管同属于侵入性操作，清醒情况下操作时患者不适感较放置鼻胃管更加强烈，而且胃镜需由专业人员进行操作，故该评估方法的使用受到限制。

5. 影像学评估

5.1. CT 评估

计算机断层扫描(CT)在临床上应用广泛，可诊断中枢神经系统、头颈胸部、腹部、盆腔组织、心血

管、骨骼等组织的疾病，此外对胃内容物的评估也有一定帮助。CT 图像以不同的灰度表示，可清楚地显示不同的组织结构，也可区分食物、液体和空气胃内容物，使用新的体积绘制软件(syngo.via^{TM}，SIEMENS Healthineers，埃尔兰根，德国)进行三维重建并测量胃内容物，其准确度为 85%~100%。对严重创伤的患者来说，胃扩张通常是由胃内空气积聚引起的，当总胃容量 ≥ 700 cm^3 时发生肺炎的风险会更高[25] [26]。

对于急诊且已行腹部 CT 检查的患者来说，可直接通过检查结果了解胃部情况，并制定相应的麻醉策略。但是 CT 设备比较昂贵，检查费用偏高，电离辐射较大，将其作为常规检查行术前的胃内容物评估并不可行。

5.2. MRI 评估

磁共振成像(MRI)是一种使用磁性和无线电波产生患者身体横截面图像的技术，在临床上用于检查神经系统、肌肉骨骼系统、心血管系统、腹腔脏器等的相关疾病[27]，在临床研究上也被用来测量胃排空[28]、评估胃运动[29]、估计胃分泌[30]等。MRI 用于胃内容物的评估时，图像上高信号(亮)表示液体，低信号(暗)表示气体，液体和气体可以很容易地识别，从而产生关于胃总体积的更详细信息，所以可用于确定麻醉前的胃残余量[28] [31] [32] [33]。

MRI 与 CT 相比成像更加清晰，且无电离辐射危害。MRI 成像速度慢，图像易受多种伪影因素影响，禁忌症较多，如体内安置金属装置的患者不可行 MRI [27]。MRI 的价格昂贵，亦不适合用于胃内容物评估的常规检查。

5.3. 超声评估

超声作为一种安全便携、容易获得成像方式的诊疗工具，正越来越多地被现代麻醉学实践所采用。在麻醉学中超声已被广泛应用于局麻、神经监测、开放血管通路、经胸聚焦超声、经食道超声和多普勒超声等方面[34]。

而胃超声的临床应用一直是有限的，现已用于评估胃壁病变[35] [36]，胃调节和排空过程中胃容量的变化[37] [38]，以及对胃窦进行连续超声扫描来评估胃排空的时间[39]。胃超声检查能够清楚地识别液体或固体胃内容物，且不同状态下的胃呈现出不同的超声图像[40] [41]，胃窦为空时，因胃窦前壁和后壁彼此非常接近，影像学表现为扁平状、圆形或卵圆形，呈现“牛眼征”或“靶征”；胃窦内为清亮液体时，超声表现为均匀一致的低回声，有时可见气泡悬浮，呈现出“星空征”；胃窦内为牛奶等浓稠液体或悬浮液时，影像学多为均匀一致的稍高回声表现；胃窦内为固体食物时，总体表现为强回声，有时因空气的干扰，沿着胃窦前壁向下的伪影使胃窦呈现磨玻璃样外观[40] [41]。

基于不同胃内容物在超声下的特殊影像表现，胃超声越来越多地被应用于术前胃内容物的评估。一项针对 6 名麻醉医生胃超声学习能力的观察性研究表明，麻醉医生在经过适当的培训和专业的超声专家指导下，在进行大约 33 次胃部超声检查后，床旁定性超声评估的成功率将达到 95% [42]。

临床上根据超声下胃窦平卧位和右侧卧位的情况，可大致判断有无胃内容物，并将胃窦分为三级[43]，即 0 级——胃窦仰卧位和右侧卧位时胃窦都是空的；1 级——仅在右侧卧位可见液体，提示胃液量较小；2 级——仰卧位和右侧卧位时胃窦内均观察到液体，提示胃液量较大。此三点分级系统可以作为区分胃内容物低容量和高容量状态的筛选工具[24]。

Bolondi 等人对胃窦进行成像，所选截面对应于穿过肠系膜上静脉的矢状面，呈椭圆形，因此胃窦的横截面积(cross-sectional area, CSA)计算为：

$$CSA = (\pi \times A \times B)/4$$

其中 A 代表胃窦纵向径，B 代表胃窦前后径[39]。

大多数便携式超声设备具有自由描记轨迹计算面积的功能，且有研究已证实双径法与自由描记法测量胃窦 CSA 是相当的[44]，自由描记法无需测量双径直接获得胃窦 CSA，在临床应用上更加方便、更具吸引力。

Anahi Perlas 等人对 18 名 5 种用餐状态下的健康志愿者进行了胃窦、胃体、胃底的超声检查，发现胃窦是最容易成像和测量的[41]，利用 CSA = (π × A × B)/4 或自由描记法来计算胃窦的横截面积，采用胃管或胃镜对胃内容物进行吸取并计量，发现胃内容物量与胃窦 CSA 呈线性相关[22] [41]，并由胃窦 CSA 来计算胃内容物量(固体颗粒胃内容物除外)，即

$$\text{Volume}(\text{ml}) = 27 + (14.6 \times \text{right lat CSA}) - 1.28 \times \text{age}$$

该公式可用于估计 0~500 ml 的胃内容量、BMI < 40 kg/m^2 的非妊娠成人患者[24]。

而妊娠晚期的孕妇的胃内容物量计算公式如下[45]：

$$\text{Volume}(\text{ml}) = -327.1 + 215.2 \times \log(\text{right lat CSA})(\text{cm}^2)$$

儿童的胃内容物量计算公式如下[46]：

$$\text{Volume}(\text{ml}) = -7.8 + (3.5 \times \text{right lat CSA}) + 0.127 \times \text{age}(\text{months})$$

根据胃窦超声检查，胃窦为 Perlas 0 级，或 Perlas 1 级且胃窦横截面积 < 340 mm^2，胃被认为是空的(胃内容物误吸至肺的风险低)。中等胃内容物指 Perlas 1 级且胃窦面积 > 340 mm^2。饱腹(全身麻醉时胃内容物吸入肺部的风险增加)指胃窦为 Perlas 2 级，无论胃窦面积如何。此种胃窦定性和定量超声检查的结合方法在几乎 90%的患者中是可行的[47]。临床上已将胃超声应用于术前胃内容物的评估，其可行性和实用性已在不同的患者群体中得到证明，包括接受择期手术[48]或紧急手术[22]的成年患者、儿童[46]、病态肥胖[49] [50]和孕妇[51] [52] [53]。

综上所述，自主功能测定、禁食指南、鼻胃管及胃镜吸引、CT、MRI、超声都可用于术前评估患者的胃内容物。但对急诊手术患者来说，胃超声对饱腹的发现要优于临床经验判断[54]。胃管与胃镜均为侵入性操作，相对而言，CT、MRI 及超声，作为外部检查仪器对评估胃内容物具有一定优势。有研究发现 CT 计算的胃内容物体积与超声测量的胃窦 CSA 有中度相关性[55]，动态 MRI 在测量胃内容物上与一种矩阵型换能器的新型 3-D 超声有极好的一致性[56]，但二者价格较昂贵，且 CT 对人体有辐射危害，而超声设备安全无创、方便携带、经济实惠，被越来越多地应用于术前胃内容物的评估，为患者的生命保驾护航。

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