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影响颅脑损伤开颅血肿清除术预后相关因素研究

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摘 要

颅脑损伤(Traumatic brain injury, TBI)为人类日常生活中常见的损伤之一，由于颅脑的固定容积及特殊的解剖学构造，故较人体其他器官不同，而因外伤所致的颅脑损伤脑出血往往较为迅速，可经头颅电子计算机断层扫描(Computed Tomography, CT)、头颅核磁共振平扫(Magnetic Resonance Imaging, MRI)、脑血管数字减影血管造影(Digital Substraction Angiography, DSA)等常规检查手段做出诊断，原则上一经发现需立即手术，而开颅血肿清清除术(craniotomy hematoma evacuation)术后患者常预后不同，手术后患者轻者常可自愈，而重者甚至死亡，本文重点论述了开颅血肿清除术预后相关因素，帮助临床医生规避及处理相关风险。

关键词

颅脑损伤，开颅血肿清除术，预后因素

Study on Related Factors Affecting the Prognosis of Craniotomy Hematoma Evacuation in Patients with Craniocerebral Injury

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Abstract

Traumatic brain injury (TBI) is one of the common injuries in human daily life. Due to the fixed volume and special anatomical structure of the cranial brain, it is different from other organs of the human body. Traumatic brain injury caused by trauma Intracerebral hemorrhage is often rapid, and routine examinations such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Digital Subtraction Angiography (DSA) of cerebral blood vessels can be performed. Diagnosis is made by means. In principle, immediate surgery is required once it is found. However, patients after craniotomy hematoma evacuation often have different prognosis. After surgery, patients with mild cases often heal themselves, while severe cases may even die. This article focuses on the prognostic factors of craniotomy hematoma evacuation were discussed to help clinicians avoid and deal with related risks.

Keywords

Traumatic Brain Injury, Craniotomy Hematoma Evacuation, Prognostic Factors

1. 引言

TBI 仍然是最具挑战性的全球公共医疗保健问题之一，而开颅血肿清除术在临床上应用十分广泛，其较低手术形成条件、简单的手术操作、较为经济的医疗费用、较令人满意的手术效果、较低的技术门槛、经典的手术操作使其在世界各个国家及地区上广泛应用，是临床上十分成熟的手术方式。但近年来，不断有研究发现因缺乏高质量的益处证据导致临床医生在实际问题处理上适应证不确定，并导致医院、国家之间甚至医院内外科医生之间的广泛实践差异。随着全球老年人口的增长以及医疗保健政策向优先考虑生活质量的转变，必须相应地调整神经外科指南[1] [2]，由于早期开颅术术式的各个细节如骨瓣的大小、入路、手术采取的时间等争论不一，故有研究认为开颅血肿清除术是作为缓解 TBI 的颅内压高的挽救性手术存在，效果不尽理想，但经过大量文章对其的研究及探讨后，开颅血肿清除术已成为一个神经外科的基础手术操作[3] [4]。而近年来，手术收益结果也不断出现大量研究进行改进探索。

2. 影响开颅血肿清除术预后的相关因素

2.1. 血肿

因为血肿的容量及位置影响到临床是否进行手术的适应症，故血肿的影响是开颅血肿清预后的最大原因，血肿的位置不尽而语，不同的血肿位置不仅确定了手术与否，更是与入路有关，而血肿容量最直接的反应莫过于占位效应，故有观点认为中线偏移程度超多血肿厚度是水肿增加，故因此二者应同时纳入考量，最大血肿厚度(Hematoma Depth, HD)和中线偏移(Midline Shift, MLS)之间的比率将因创伤引起的相关内在脑病理学而异，其认为术前 CT 脑部血肿 HD/MLS 比值的的中线，即 HD/MLS < 0.79 (P = 0.00435)与血肿体积超过 40 cm (P = 0.0355)为不良预后因素[5]，İlhan Yılmaz 等 8 人研究概括了平均血肿厚度为 15.46 ± 5.73 mm，平均中线偏移为 9.90 ± 4.84 mm。死亡率与 ADSH 患者过度中线偏移(P = 0.011; r = 0.262)

正相关，≥10 mm 的中线偏移和≥15 mm 的血肿厚度与死亡率显著相关(P = 0.014; P = 0.039) [6]。

2.2. 手术方式

传统的开颅血肿清除术虽然是经典术式，其应用广，技术门槛低，但为了使得患者拥有较好的生存期和较少的并发症，故而涌现许多改良及创新术式，例如微创内窥镜治疗的 90 例患者在发病 72 小时内研究使用微创内窥镜下治疗脑出血后与幕上出血相比表明微创有较好的长期有利的结局，但同传统手术一样，该手术亦强调手术开始的时间、出血位置、患者年龄、是否有脑室出血等。这虽是一个新型手术探索方式但该手术仍需大量动物实验及多中心研究证实[7]，另外对于位置较深且手术难度大的传统开颅手术血肿出现了立体定向抽吸方式，值得注意的是，在血肿体积 > 60 mL 或格拉斯哥昏迷量表评分为 4~8 分的严重患者应用立体定向手术可能比其他两种外科手术更能从内镜手术中获益[8]。

2.3. 颅内压(Intracranial Pressure, ICP)

ICP 监测是贯穿于颅脑损伤病理生理中的，并已被认定为影响患者预后的重要因素，在首次开颅手术后，由于 ICP 急剧升高，一些患者出现临床恶化，在这些情况下，进行初始血肿清除术可能会降低颅 ICP，最终获得更好的结果[3] [9]。大脑由于包裹在一个骨性固定容器中，故影响 ICP 最大的脑容量及血容量的增加会使颅内压增高[10] [11]，颅脑损伤带来的脑组织严重水肿使得大脑可扩张用空间体积减少，顺应性减低，压力－容积曲线左移，脑组织加重缺氧，氧自由基地等加重脑损伤[11] [12] [13] [14] [15]。血肿的压力梯度也是反应 ICP 的方面之一。脑血肿压力大于脑组织，清除血肿过程中压力逐渐递减，压力方向开始相反，有利于脑组织回复，而锁孔内窥镜术式有利于压力的释放，较其他术式来说更有利脑组织收缩，使得血肿易清除[16]。

2.4. 手术开始时间

由于患者受伤后的出血存在隐匿与滞后性，且抵达就近的医疗机构时间不一，故而预后结局不一，一项兔子实验认为微创手术最佳手术时间应为出血发生后的 24 小时内，因为在该时间段内行微创手术后清除脑内血肿可以降低血脑屏障通透性，减少脑水肿，尤其是出血后 6 小时内行微创手术效果更明显[17]。有文献显示，与 1981 年的 Seelig 等人报道从受伤到手术的最初 4 小时内手术后死亡率高达 80%，而 4 小时内手术后死亡率可达 90%。因此美国卫生机构建议入院后急诊应在 4 小时内完善检查及诊断，并行即使采取相关护理。但现在由于大宗研究的统一研究故而不同文献对于患者入院具体时间有着不同的争论，但均认为患者受伤后应尽早行手术治疗[18]。

2.5. 患者年龄

患者年龄是一项重要因素，随着年龄的增长，机体对外界损伤耐受下降，死亡率增加[19] [20] [21]，全世界普遍面临的人口老龄化将导致老年人创伤性脑损伤数量增加，从而导致重大公共卫生和社会经济问题，美国疾病控制和预防中心的统计数据显示，2008 年至 2017 年间，美国与意外跌倒相关的 TBI 增加了 17% [22]。重要的是，继发于跌倒相关 TBI 的 75 岁及以上成年人的死亡率不成比例地高，为每 10 万人年 54.08 人，而 75 岁以下的人为每 10 万人 8 人。据估计，到 2050 年，65 岁以上的人群将达到约 15 亿人，因此迫切需要对 TBI 老年患者进行有效和务实的管理[23]。尤其以老年人的急性硬膜下血肿(Acute Subdural Hematoma, ASDH)的手术治疗仍然是有争议的问题较为突出，在老年人中，神经外科医生试图在尽可能在保守治疗与手术之间取得平衡，同时避免同时进行减压颅骨切除术的缺点[24] [25]，Daniel Pinggera 等人的回顾性研究研究发现在标准开颅(Craniotomy Size, SC)即开颅大小 > 8 cm 和有限开颅(Limited Craniotomy, LC)即开颅大小 < 8 cm 结合影像学仲分析了 64 例 75 岁或以上患者。主要结局参

数是 30 天死亡率。次要结局参数是放射学。发现组间无差异，开颅手术窗口大小几乎相等。与 LC 组相比，SC 组的死亡率显着更高(68.4%对 31.6%; P = 0.045)。而 Akbik OS 等人的另一项纳入 62 例 65 岁以上患者的系列研究发现死亡率为 37% [3] SC 组术前 HD (P = 0.08)和 MLS (P = 0.09)显著较高，而术后放射学评估显示 HD 或 MLS 无显著差异。因此有限的开颅手术足以诊治，从而获得相同的放射学和临床结果[26]。

2.6. 入院时格拉斯哥昏迷评分法(Glasgow Coma Scale, GCS)

GCS 评分是目前公认的预后相关因素，其分值的大小反映了患者预后的严重性，Kim 对 135 例患者进行开颅减压术后认为手术适应证采取 GCS 评分小于 8 或 CT 中线移位超过 6 mm，并在减压颅骨切除术后 6 个月评估临床结局得出 TBI 患者的死亡率 21.4%，另根据损伤昏迷数据库研究认为入院时评分在 8 分以下的患者总死亡率为 33%，处于植物状态的约为 14%，获得良好预后的仅为 7% [6]。初始 GCS 为 3~5 的非常老的患者与 GCS6-15 [27] [31]。此外，80 岁以上的患者在危重后死亡的率为 50%，只有 4 分之一的患者恢复到院前功能[26] [28] [29] [30]。

2.7. 开颅骨瓣尺寸

开颅骨瓣的大小对于清除血肿及减压有着十分重要的价值，Ji-Yao Jiang 等研究标准创伤颅骨切除术(Standard Traumatic Craniotomy, STC)与局限性颅骨切除术(Limited Craniotomy，LC)对严重创伤性脑损伤纳入了 486 名重度 TBI(格拉斯哥昏迷量表评分小于等于 8)患者。一组接受单侧额颞顶骨瓣(12 × 15 cm)，第二组接受 LC 和常规颞顶骨皮瓣(6 × 8 cm)。STC 取得了良好的结果，相比之下，LC 组有不利的结局较多，除这些发现外，STC 组延迟颅内血肿、切口疝和脑脊液瘘的发生率低于 LC 组($p < 0.05$)，但两组急性脑脊髓膨、创伤性癫痫发作和颅内感染的发生率没有显著差异($p > 0.05$)。该研究表明，STC 显著改善了单侧额颞顶动脉挫伤伴或不伴有脑内或硬膜下血肿的难治性颅内高压的重度 TBI 结局。这表明对于此类患者，建议使用 STC 而不是 LC [32]。而 Ramazan Jabbarli 等人认为，较大的减压颅骨切除术的大小对于患者的预后至关重要，若以 ICP 为终点评价大骨瓣面积(>105 cm^2)与脑梗死风险(调整比值比[aOR] 0.30，95%可信区间[CI] 0.16~0.56)、院内死亡率(aOR 0.28, 95% CI 0.14~0.56)和不良结局(aOR 0.51, 95% CI 0.27~0.98)的风险独立相关。若尺寸小(<75 cm)更有可能需要术后 ICP 治疗延长[33]。

2.8. 术前生理指标及体征

术前的生理指标是患者在颅脑损伤后最直观的表现，也是反映了创伤后的机体耐受手术可能性，有研究手术术后 30 天死亡率的预测因素包括年龄、双侧无反应性瞳孔、术中低血压(Low Hypotension, IH)、术前激活部分凝血活酶时间和损伤严重程度评分之间的预后比较关系示双侧不反应性瞳孔(OR, 12.734; 95% CI, 4.129~39.270; P < 0.001)术中低血压(OR, 11.532; 95% CI，4.222~31.499; P < 0.001)，术前活化部分凝血活酶时间(OR, 6.905; 95% CI, 2.055~23.202; P = 0.002) [34]另外 IH 也是影响术后预后之一，一项来自 2022 年的研究显示含有 83 名患者其中有 IH 的为 54%。IH 和非 IH 组的住院死亡率分别为 44%和 26% (P = 0.138)。GCS 1~3 分、术中失血量是 TBI 患者手术期间 IH 相关的危险因素[35]。

2.9. 高海拔

高原地区脑出血较平原地区后果及预后往往更为严重，因为海拔与氧气分布关系，在人类生理指标中有两项较为重要，分别是血氧分压(Partial Pressure of Oxygen, PaO_2)和血氧饱和度(Oxygen Saturation, SaO_2)故而往往在高海拔地区患者；颅脑外伤后可因脑组织缺氧及血流量分布的异常加重脑肿胀成程度，并较平原地区发展迅速，也更容易产生脑疝，再加上高海拔地区基础建设较平原地区差，交通不便等原

因故而手术时间延搁较长，加重病情恶化[35]。一篇来高原猪的动物模型显示，脑出血的高原动物仅在两项指标 PaO_2、SaO_2 高于普通高原动物，而其他生理指标并无差异，高原脑出血引起的水肿可导致更高的ICP，最终导致更严重的神经功能缺损[36]。而印度团队认为高原低压低氧的环境下带来了人体代偿性的红细胞增多及血红蛋白升高使得血粘滞度较平原高，致使血流量不足，在脑出血后更容易造成脑组织缺氧[18]，因此我国高原地区的颅脑损伤应使得临床医师需格外重视氧气的管理。例如高原外伤患者受伤后应尽早必须行颅脑 CT 平扫检查排除颅内活动性出血和脑脊液漏的患者后今尽早行高压氧支持治疗改善大脑脑血流量，高压氧可以使椎动脉的血流量增加 18%，提高脑组织供氧量[37]，若有条件者应迅速转诊至有条件的高级诊疗中心行机械通气，在机械通气中早期应避免长时间的过度通气，否则将破坏吸氧 $PaCO_2$ 降低和酸碱度升高,致使脑血管收缩,脑血流量降低,达到降 ICP [38]。

3. 展望

颅脑损伤涉及范围广，影响因素众多且互相作用，还有相当多的影响预后的假设并未发现及证明，相关论文层出不穷，改进与经研究日新月异，今后还会出现更多颠覆以往认知的因素出现，更需要大量临床研究和动物实验证实。

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