·临床研究·

急性硬膜外血肿血肿量对颅骨切开术骨瓣设计的要求

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【摘要】 **目的** 初步探讨无需行去骨瓣减压术的急性幕上硬膜外血肿行开颅血肿清除术应选择的骨瓣大小。**方法** 共191例急性幕上硬膜外血肿患者分别采取3 cm小骨窗(67例)、5 cm小骨窗(61例)和常规骨瓣(63例)开颅血肿清除术,记录手术时间、术中出血量、血肿清除范围、残留血肿量和术后中线移位、环池结构。**结果** 191例患者中血肿最大径≤8 cm 47例、>8~10 cm 106例和>10 cm 38例。血肿最大径≤8 cm时,与常规骨瓣组相比,3 cm小骨窗组血肿清除范围小($t=-3.370$,$P=0.002$)、手术时间短($t=-14.469$,$P=0.000$)、术中出血量少($t=-9.310$,$P=0.000$);与3 cm小骨窗组相比,5 cm小骨窗组血肿清除范围大($t=-2.331$,$P=0.026$)。血肿最大径>8~10 cm时,与常规骨瓣组相比,5 cm小骨窗组血肿清除范围小($t=-4.248$,$P=0.002$)、残留血肿量少($t=-2.083$,$P=0.041$)、手术时间短($t=-10.715$,$P=0.000$)、术中出血量少($t=-10.828$,$P=0.000$)。血肿最大径>10 cm时,与常规骨瓣组相比,5 cm小骨窗组血肿清除范围小($t=-3.125$,$P=0.003$)、手术时间短($t=-2.948$,$P=0.006$),但残留血肿量增加($t=3.478$,$P=0.001$)。Spearman秩相关分析显示,骨窗缘可操作视角与骨窗大小($r_s=0.330$,$P=0.000$)和血肿最大径($r_s=0.177$,$P=0.003$)呈正相关,与血肿厚度呈负相关($r_s=-0.678$,$P=0.000$)。**结论** 在有效清除血肿并取得满意影像学和临床康复前提下,为达微创手术效果,急性幕上硬膜外血肿最大径≤8 cm时,血肿量≤50 ml者可选择3 cm小骨窗、>50 ml者可选择5 cm小骨窗;血肿最大径>8~10 cm时,可选择5 cm小骨窗;血肿最大径>10 cm时,可选择常规骨瓣(骨瓣长径≥6 cm)。

【关键词】 血肿,硬膜外,颅内; 颅骨切开术

Requirements on the designation of craniotomy flap according to the volume of acute epidural hematoma

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【**Abstract**】 **Objective** To investigate the most reasonable size of craniotomy flap in hematoma removal craniotomy for acute supratentorial epidural hematoma (EDH) with no need of decompressive craniectomy. **Methods** Surgical and clinical data of 191 patients with acute supratentorial EDH were retrospectively reviewed and their operation time, intraoperative blood loss, range of hematoma evacuation, residual hematoma, postoperative midline shift and ambient cistern were compared among 3 groups (3 cm craniotomy group, N = 67; 5 cm craniotomy group, N = 61; ordinary craniotomy group, N = 63). **Results** For EDHs with maximal diameter ≤ 8 cm (N = 47), compared with ordinary craniotomy, 3 cm craniotomy achieved smaller range of hematoma evacuation ($t=-3.370$, $P=0.002$), shorter operation time ($t=-14.469$, $P=0.000$) and less intraoperative blood loss ($t=-9.310$, $P=0.000$). However, 5 cm craniotomy could obtain larger range of hematoma evacuation compared with 3 cm craniotomy ($t=-2.331$, $P=0.026$). For EDHs with maximal diameter > 8–10 cm (N = 106), compared with ordinary craniotomy, 5 cm craniotomy achieved smaller range of hematoma evacuation ($t=-4.248$, $P=0.002$), smaller residual hematoma ($t=-2.083$, $P=$

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0.041), shorter operation time (t = - 10.715, P = 0.000) and smaller intraoperative blood loss (t = - 10.828, P = 0.000). For EDHs with maximal diameter > 10 cm (N = 38), compared with ordinary craniotomy group, although 5 cm craniotomy could reduce range of hematoma evacuation (t = - 3.125, P = 0.003) and operation time (t = - 2.948, P = 0.006), it could notably increase the residual hematoma (t = 3.478, P = 0.001). Spearman rank correlation analysis suggested that the operable angle on the edge of craniotomy defect was positively correlated with size of craniotomy defect (r_s = 0.330, P = 0.000) and maximal hematoma diameter (r_s = 0.177, P = 0.003), and negatively correlated with hematoma thickness (r_s = - 0.678, P = 0.000). **Conclusions** With prerequisite of effective EDH evacuation and satisfactory radiological and clinical recovery, the EDH is recommended to be microsurgically treated with craniotomy in rational size. For maximal diameter ≤ 8 cm EDHs and hemotome volume ≤ 50 ml, 3 cm craniotomy is the best choice, whereas the 5 cm craniotomy is more suitable when the hematoma volume > 50 ml. For maximal diameter > 8–10 cm EDHs, 5 cm craniotomy is a more rational surgical approach. And for maximal diameter > 10 cm EDHs, ordinary craniotomy (≥ 6 cm) is recommended.

【Key words】 Hematoma, epidural, cranial; Craniotomy

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对于无需行去骨瓣减压术的急性硬膜外血肿(EDH)患者,开颅血肿清除术常采用常规骨瓣开颅或小骨窗开颅[1],两种术式各有利弊[2],本质区别在于是否基于微创理念设计最美观的头皮切口和最适宜的骨瓣大小并获得最佳的手术疗效。本研究回顾分析近5年解放军第一七五医院诊断与治疗的191例无需行去骨瓣减压术的急性幕上硬膜外血肿患者的临床资料,初步探讨术式的合理化选择和骨瓣的优化设计,现总结报告如下。

对象与方法

一、研究对象

选择2011年1月–2015年12月解放军第一七五医院诊断与治疗的无需行去骨瓣减压术的急性幕上硬膜外血肿患者共191例,血肿量均>30 ml;排除合并严重循环和呼吸系统疾病、合并重要脏器严重损伤、局部或对冲部位严重脑挫裂伤、多发性粉碎性骨折,以及脑膜中动脉和静脉窦活动性出血患者。男性155例,女性36例;年龄4~76岁,平均(36.61±17.23)岁;发病至入院时间0.50~6.00 h,平均(1.21±0.38)h;单纯硬膜外血肿64例(33.51%),合并颅骨骨折186例(97.38%),轻度局部或对冲性脑挫裂伤127例(66.49%)。术前头部CT显示血肿最大径5.80~12.70 cm,平均(8.99±1.52)cm;血肿量46~102 ml,平均(78.25±36.14)ml;中线移位3~16 mm,平均(9.01±2.87)mm;根据鹿特丹CT评分(Rotterdam CT Score),中线移位评分0分(中线移位≤5 mm)15例(7.85%)、1分(中线移位>5 mm)176例(92.15%);环池评分0分(环池正常)41例(21.47%)、1分(环池受压)115例(60.21%)、2分(环池消失)35例(18.32%)。入院时Glasgow昏迷量表(GCS)评分9~15分,平均(11.94±2.92)分;术前脑疝形成41例(21.47%),脑疝形成时间15~78 min、中位时间46.25(30.00,65.00)min。所有患者根据术者临床经验予以小骨窗或常规骨瓣开颅血肿清除术,根据术中骨瓣直径分为3组,即直径3 cm小骨窗组、直径5 cm小骨窗组和直径≥6 cm常规骨瓣组。3种术式均遵守医疗技术操作原则,并获得我院道德伦理委员会审核批准,所有患者或其家属均知情同意并签署知情同意书。

二、研究方法

1.手术方法 (1)直径3 cm小骨窗组(图1):常规术前准备,患者仰卧位,于全身麻醉下取头皮直切口,长度5~7 cm,乳突撑开器撑开头皮,电动环钻或气(电)动钻铣刀形成圆形小骨窗,骨窗直径约为3 cm,骨瓣一般以血肿最厚处为中心,清除骨窗下缘和周围血肿,对于骨窗边缘残留少许血肿,并非一定彻底清除,以避免硬脑膜剥离出现新的硬膜外血肿,清除血肿后硬脑膜上的动脉或静脉出血应予电凝或悬吊止血,随后悬吊硬脑膜,由于受到手术视野的限制,悬吊硬脑膜存在一定困难,悬吊时先将悬吊针与持针器呈150°角、持针器与骨窗缘呈30°角,尽量接近血肿边缘,悬吊4~6针,再于每2针悬吊线之间近骨窗缘再悬吊1针,即可取得良好悬吊效果。回纳骨瓣,头皮下放置引流管,缝合头皮。(2)直径5 cm小骨窗组(图2):取"S"形头皮切口,长度约6 cm、宽度约3 cm,骨窗直径约5 cm,余手术过程同直径3 cm小骨窗组。(3)常规骨瓣组(图3):根

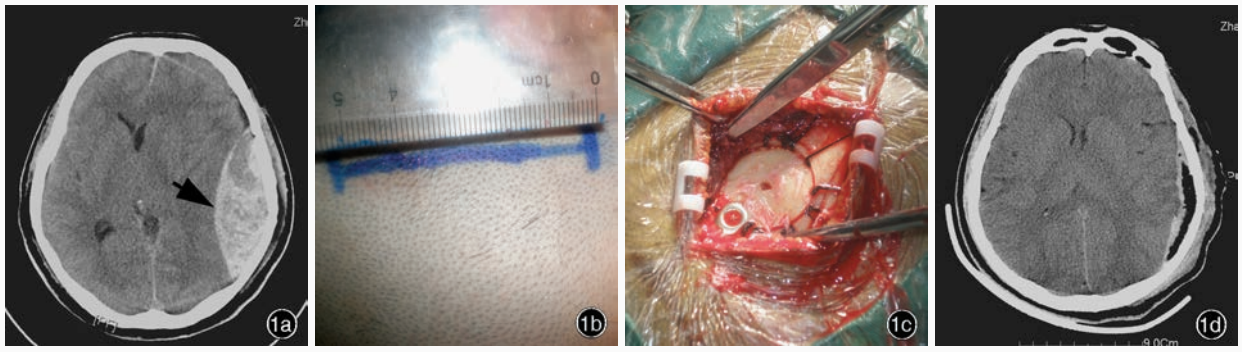


图1 男性患者，57岁，临床诊断为左侧颞顶部硬膜外血肿，行3 cm小骨窗开颅血肿清除术 1a 术前CT显示，左侧颞顶部硬膜外血肿（箭头所示），中线明显右偏 1b 术中取长约6 cm头皮直切口 1c 术中取骨窗大小约3 cm 1d 术后复查CT显示，血肿清除彻底，中线结构基本居中

Figure 1 A 57-year-old male patient with left temporo-parietal epidural hematoma was treated by 3 cm craniotomy for hematoma removal. Preoperative cranial CT showed left temporo-parietal epidural hematoma (arrow indicates) accompanied by obviously right shifted midline structure (Panel 1a). A 6 cm straightforward scalp incision was made during the operation (Panel 1b). A 3 cm craniotomy defect was made during the operation (Panel 1c). Postoperative CT showed that the epidural hematoma was totally removed with a repositioned midline structure (Panel 1d).

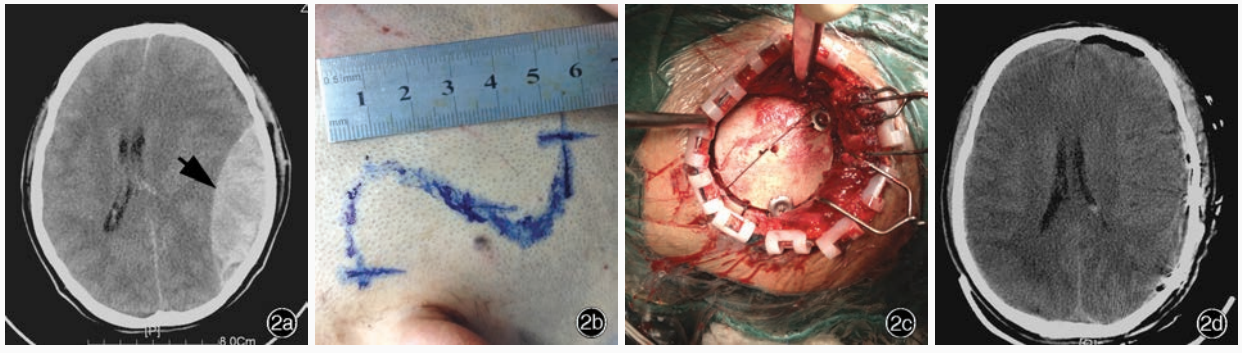


图2 男性患者，50岁，临床诊断为左侧颞顶部硬膜外血肿，行5 cm小骨窗开颅血肿清除术 2a 术前CT显示，左侧颞顶部硬膜外血肿（箭头所示），中线明显右偏 2b 术中取长约6 cm、宽约3 cm “S”形头皮切口 2c 术中取骨窗大小约5 cm 2d 术后复查CT显示，血肿清除彻底，中线结构基本居中

Figure 2 A 50-year-old male patient with left temporo-parietal epidural hematoma was treated by 5 cm craniotomy for hematoma removal. Preoperative cranial CT showed left temporo-parietal epidural hematoma (arrow indicates) accompanied by obviously right shifted midline structure (Panel 2a). An S-shaped scalp incision, which was approximately 6 cm in length and 3 cm in width, was made during the operation (Panel 2b). A 5 cm craniotomy defect was made during the operation (Panel 2c). Postoperative CT showed that the epidural hematoma was totally removed with a repositioned midline structure (Panel 2d).

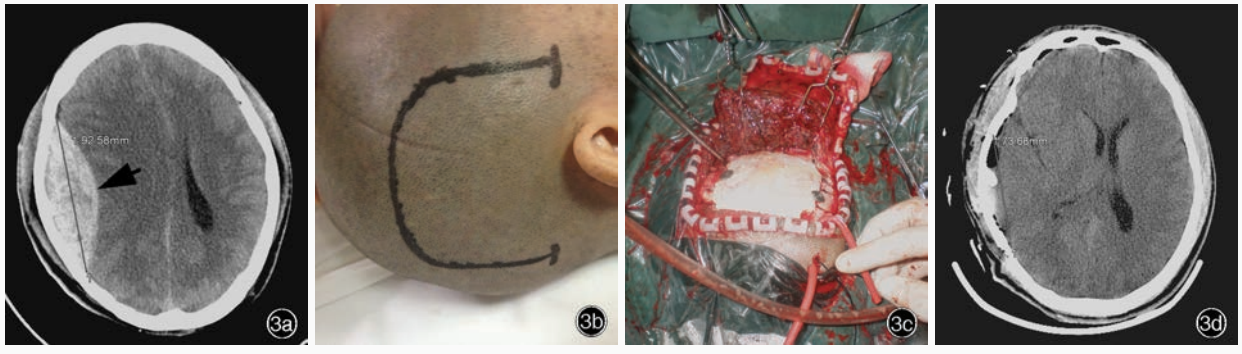


图3 男性患者，47岁，临床诊断为右侧颞顶部硬膜外血肿，行常规骨瓣开颅血肿清除术 3a 术前CT显示，右侧颞顶部硬膜外血肿（箭头所示），中线明显左偏 3b 术中取长约20 cm“∩”形头皮切口 3c 术中取骨窗大小约7 cm 3d 术后复查CT显示，血肿清除彻底，中线结构基本居中

Figure 3 A 47-year-old male patient with right temporo-parietal epidural hematoma was treated by ordinary craniotomy for hematoma removal. Preoperative cranial CT showed left temporo-parietal epidural hematoma (arrow indicates) accompanied by obviously left shifted midline structure (Panel 3a). A ∩-shaped scalp incision, which was approximate 20 cm in length, was made during the operation (Panel 3b). A 7 cm craniotomy defect was made during the operation (Panel 3c). Postoperative CT showed that the epidural hematoma was totally removed with a repositioned midline structure (Panel 3d).

据血肿量设计手术切口和骨窗大小，一般选择“∩”形或“?”形头皮切口，长度≥15 cm，骨窗缘尽可能接近血肿边缘，骨瓣长径≥6 cm，手术过程同小骨窗组。

2.疗效评价 包括手术时间、术中出血量，以及术后复查头部CT，观察血肿清除范围、残留血肿量、中线移位和环池结构、有无再出血和继发性脑梗死或脑水肿等。

3.统计分析方法 采用SPSS 20.0统计软件进行数据处理与分析。呈正态分布的计量资料以均数±标准差（$\bar{x} \pm s$）表示，采用单因素方差分析，两两比较行LSD-t检验；呈非正态分布的计量资料以中位数和四分位数间距[$M(P_{25}, P_{75})$]表示，采用Kruskal-Wallis秩和检验（H检验）。计数资料以相对数构成比（%）或率（%）表示，采用χ^2检验。骨窗缘可操作视角与骨窗大小的相关分析，采用Spearman秩相关分析。以$P \leq 0.05$为差异具有统计学意义。

结 果

一、一般资料的比较

本组191例患者分为直径3 cm小骨窗组67例、直径5 cm小骨窗组61例、直径≥6 cm常规骨瓣组63例。（1）3 cm小骨窗组：67例患者，男性51例，女性16例；年龄4～68岁，平均（36.74±16.14）岁；发病至入院时间0.50～6.00 h，平均（1.20±0.35）h；单纯硬膜外血肿23例（34.33%），合并颅骨骨折64例（95.52%），轻度局部或对冲性脑挫裂伤44例（65.67%）。术前头部CT显示血肿最大径5.80～9.40 cm，平均（8.12±1.20）cm；血肿量46～82 ml，平均（64.02±22.63）ml；中线移位3～9 mm，平均为（7.83±2.71）cm；中线移位评分0分14例（20.90%）、1分53例（79.10%）；环池评分0分者15例（22.39%）、1分43例（64.18%）、2分9例（13.43%）。入院时GCS评分10～15分，平均（11.82±2.44）分；术前脑疝形成8例（11.94%），脑疝形成时间为15～75 min、中位时间56（45，65）min。（2）5 cm小骨窗组：61例患者，男性52例，女性9例；年龄17～66岁，平均为（35.34±14.32）岁；发病至入院时间0.50～6.00 h，平均（1.24±0.31）h；均合并颅骨骨折，单纯硬膜外血肿18例（29.51%），轻度局部或对冲性脑挫裂伤43例（70.49%）。术前头部CT显示血肿最大径8.90～12.70 cm，平均（9.30±1.14）cm；血肿量66～102 ml，平均为（84.03±24.41）ml；中线移位为6～15 mm，平均为（9.50±2.72）mm；中线移位评分均为1分；环池评分0分12例（19.67%）、1分37例（60.66%）、2分12例（19.67%）。入院时GCS评分为10～15分，平均为（12.04±2.23）分；术前脑疝形成13例（21.31%），脑疝形成时间15～70 min、中位时间64（60，66）min。（3）常规骨瓣组：63例患者，男性52例，女性11例；年龄35～76岁，平均（38.72±16.03）岁；发病至入院时间0.50～6.00 h，平均为（1.33±0.24）h；单纯硬膜外血肿23例（36.51%），合并颅骨骨折61例（96.83%），轻度局部或对冲性脑挫裂伤40例（63.49%）。术前头部CT显示血肿最大径7.60～12.50 cm，平均（9.63±1.32）cm；血肿量62～102 ml，平均为（89.82±31.44）ml；中线移位为8～16 mm，平均为（9.81±2.62）cm；中线移位评分0分者1例（1.59%）、1分62例（98.41%）；环池评分0分14例（22.22%）、1分35例（55.56%）、2分14例（22.22%）。入院时GCS评分9～15分，平均（11.91±2.61）分；术前脑疝形成20例（31.75%），脑疝形成时间30～78 min、中位时间65（50，70）min。表1结果显示，3组患者血肿最大径（$P=0.000$）、血肿量（$P=0.000$）、中线移位（$P=0.000$）、术后中线移位评分（$P=0.000$）、脑疝形成比例（$P=0.023$）和脑疝形成时间（$P=0.008$）差异有统计学意义，其余各项资料差异无统计学意义（均$P>0.05$）。

二、3种术式手术疗效的比较

根据患者血肿最大径的四分位数（8.00、8.90和9.80 cm）分4个区间：血肿最大径≤8 cm（47例）、>8～9 cm（57例）、>9～10 cm（49例）、>10 cm（38例），比较每种情况3种术式的手术疗效。

1.血肿最大径≤8 cm 当血肿最大径≤8 cm时，由表2可见，3 cm小骨窗、5 cm小骨窗和常规骨瓣开颅血肿清除术患者血肿清除范围（$P=0.001$）、手术时间（$P=0.000$）、术中出血量（$P=0.000$）差异有统计学意义，而残留血肿量、中线移位、术后中线移位评分和环池评分差异无统计学意义（均$P>0.05$）。其中，与常规骨瓣组相比，3 cm小骨窗组血肿清除范围小（$t=-3.370$，$P=0.002$）、手术时间短（$t=-14.469$，$P=0.000$）、术中出血量少（$t=-9.310$，$P=0.000$）；与3 cm小骨窗组相比，5 cm小骨窗组血肿清除范围大（$t=-2.331$，$P=0.026$），而手术时间（$t=0.982$，$P=0.328$）和术中出血量（$t=0.289$，$P=0.772$）差异无统计学意义，提示血肿最大径≤8 cm时最适宜采用3 cm小骨窗开颅血肿清除术。

表1 3组患者一般资料的比较

Table 1. Comparison of general data among 3 groups

Item	3 cm craniotomy (N = 67)	5 cm craniotomy (N = 61)	Ordinary craniotomy (N = 63)	Statistic value	*P* value
Sex [case (%)]				2.442	0.295
Male	51 (76.12)	52 (85.25)	52 (82.54)		
Female	16 (23.88)	9 (14.75)	11 (17.46)		
Age ($\bar{x} \pm s$, year)	36.74 ± 16.14	35.34 ± 14.32	38.72 ± 16.03	0.742	0.478
Time from injury to admission ($\bar{x} \pm s$, h)	1.20 ± 0.35	1.24 ± 0.31	1.33 ± 0.24	3.079	0.048
Isolated EDH [case (%)]	23 (34.33)	18 (29.51)	23 (36.51)	0.713	0.700
Concurrent skull fracture [case (%)]	64 (95.52)	61 (100.00)	61 (96.83)	2.625	0.269
Concurrent moderate local or contrecoup cerebral contusion [case (%)]	44 (65.67)	43 (70.49)	40 (63.49)	0.713	0.700
Hematoma maximal diameter ($\bar{x} \pm s$, cm)	8.12 ± 1.20	9.30 ± 1.14	9.63 ± 1.32	27.552	0.000
Hematoma volume ($\bar{x} \pm s$, ml)	64.02 ± 22.63	84.03 ± 24.41	89.82 ± 31.44	17.209	0.000
Midline shift ($\bar{x} \pm s$, mm)	7.83 ± 2.71	9.50 ± 2.72	9.81 ± 2.62	10.290	0.000
Grade of midline shift [case (%)]				24.365	0.000
0 score (≤ 5 mm)	14 (20.90)	0 (0.00)	1 (1.59)		
1 score (> 5 mm)	53 (79.10)	61 (100.00)	62 (98.41)		
Status of ambinent cistern [case (%)]				1.996	0.736
0 score (normal)	15 (22.39)	12 (19.67)	14 (22.22)		
1 score (compressed)	43 (64.18)	37 (60.66)	35 (55.56)		
2 score (disappeared)	9 (13.43)	12 (19.67)	14 (22.22)		
GCS ($\bar{x} \pm s$, score)	11.82 ± 2.44	12.04 ± 2.23	11.91 ± 2.61	0.131	0.877
Mydriasis [case (%)]	8 (11.94)	13 (21.31)	20 (31.75)	7.556	0.023
Duration of cerebral hernia [M (P_{25}, P_{75}), min]	56 (45, 65)	64 (60, 66)	65 (50, 70)	9.970	0.008

One-way ANOVA for comparison of age, time from injury to admission, hematoma maximal diameter, hematoma volume, midline shift and GCS, Kruskal-Wallis rank test (H test) for comparison of duration of cerebral hernia, and χ^2 test for comparison of others。EDH，epidural hematoma，硬膜外血肿；GCS，Glasgow Coma Scale，Glasgow昏迷量表

表2 血肿最大径 ≤ 8 cm患者3种术式手术疗效的比较

Table 2. Comparison of surgical efficacy among 3 surgical approaches for maximal diameter ≤ 8 cm EDHs

Item	3 cm craniotomy (N = 32)	5 cm craniotomy (N = 6)	Ordinary craniotomy (N = 9)	F or χ^2 value	*P* value
Range of hematoma evacuation ($\bar{x} \pm s$, cm)	6.92 ± 0.60	7.51 ± 0.33	7.61 ± 0.22	7.916	0.001
Residual hematoma ($\bar{x} \pm s$, ml)	1.21 ± 1.33	1.03 ± 1.14	1.91 ± 1.31	1.180	0.317
Operation time ($\bar{x} \pm s$, min)	58.01 ± 6.52	55.03 ± 8.43	97.81 ± 9.71	107.357	0.000
Intraoperative blood loss ($\bar{x} \pm s$, ml)	120.31 ± 28.03	116.74 ± 25.82	216.72 ± 25.04	46.158	0.000
Midline shift ($\bar{x} \pm s$, mm)	0.92 ± 1.01	1.60 ± 0.72	1.32 ± 0.64	1.737	0.188
Grade of postoperative midline shift [case (%)]				—	—
0 score (≤ 5 mm)	32 (100.00)	6 (100.00)	9 (100.00)		
1 score (> 5 mm)	0 (0.00)	0 (0.00)	0 (0.00)		
Status of postoperative ambient cistern [case (%)]				1.381	0.501
0 score (normal)	29 (90.62)	5 (83.33)	9 (100.00)		
1 score (compressed)	3 (9.38)	1 (16.67)	0 (0.00)		
2 score (disappeared)	0 (0.00)	0 (0.00)	0 (0.00)		

χ^2 test for comparison of grade of postoperative midline shift and status of postoperative ambient cistern, and one-way ANOVA for comparison of others。—, the calculation of χ^2 value could not be carried out because at least one expected frequency was 0 in the contingency table, 列联表中至少一项期望频数为零无法计算χ^2值

表3 血肿最大径>8~10 cm患者3种术式手术疗效的比较

Table 3. Comparison of surgical efficacy among 3 surgical approaches for maximal diameter >8–10 cm EDHs

Item	3 cm craniotomy (N = 31)	5 cm craniotomy (N = 41)	Ordinary craniotomy (N = 34)	F or χ^2 value	P value
Range of hematoma evacuation ($\bar{x} \pm s$, cm)	7.69 ± 0.43	8.66 ± 0.38	9.03 ± 0.37	100.579	0.000
Residual hematoma ($\bar{x} \pm s$, ml)	8.31 ± 5.03	2.29 ± 1.64	2.07 ± 1.06	46.865	0.000
Operation time ($\bar{x} \pm s$, min)	93.71 ± 15.46	65.59 ± 6.83	101.42 ± 20.08	55.187	0.000
Intraoperative blood loss ($\bar{x} \pm s$, ml)	260.16 ± 96.48	149.44 ± 35.17	292.29 ± 75.21	39.376	0.000
Midline shift ($\bar{x} \pm s$, mm)	2.68 ± 1.46	2.51 ± 1.12	2.55 ± 0.94	0.193	0.825
Grade of postoperative midline shift [case (%)]				2.409	0.300
0 score (≤ 5 mm)	28 (90.32)	40 (97.56)	33 (97.06)		
1 score (> 5 mm)	3 (9.68)	1 (2.44)	1 (2.94)		
Status of postoperative ambient cistern [case (%)]				2.671	0.263
0 score (normal)	26 (83.87)	36 (87.80)	25 (73.53)		
1 score (compressed)	5 (16.13)	5 (12.20)	9 (26.47)		
2 score (disappeared)	0 (0.00)	0 (0.00)	0 (0.00)		

χ^2 test for comparison of grade of postoperative midline shift and status of postoperative ambient cistern, and one-way ANOVA for comparison of others。The same for table below

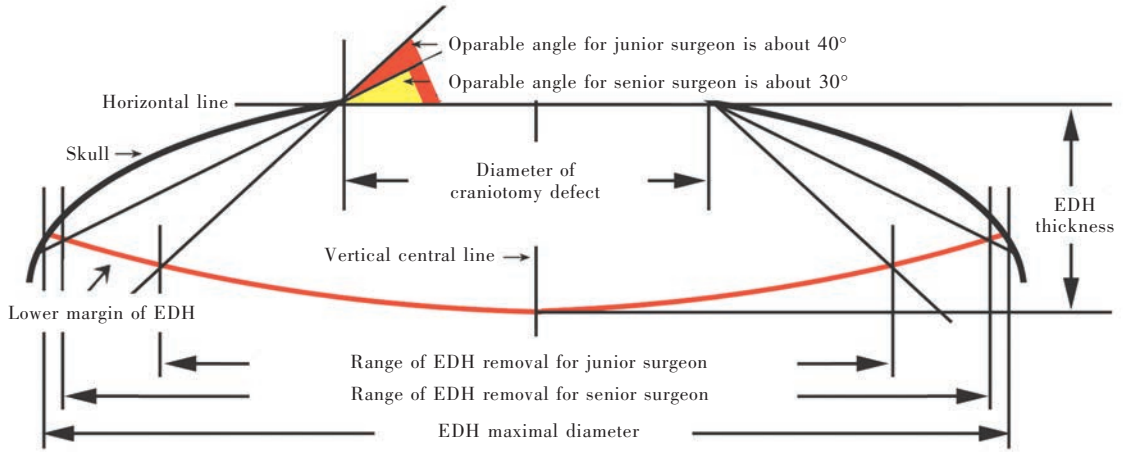
表4 血肿最大径>10 cm患者3种术式手术疗效的比较

Table 4. Comparison of surgical efficacy among 3 surgical approaches for maximal diameter >10 cm EDHs

Item	3 cm craniotomy (N = 4)	5 cm craniotomy (N = 14)	Ordinary craniotomy (N = 20)	F or χ^2 value	P value
Range of hematoma evacuation ($\bar{x} \pm s$, cm)	8.23 ± 0.32	9.84 ± 0.63	10.72 ± 0.91	18.638	0.000
Residual hematoma ($\bar{x} \pm s$, ml)	12.53 ± 2.92	9.42 ± 5.62	4.53 ± 2.41	10.412	0.000
Operation time ($\bar{x} \pm s$, min)	97.54 ± 17.12	96.42 ± 21.03	119.33 ± 23.13	5.074	0.012
Intraoperative blood loss ($\bar{x} \pm s$, ml)	300.02 ± 168.31	335.73 ± 121.61	397.51 ± 115.32	1.652	0.206
Midline shift ($\bar{x} \pm s$, mm)	4.14 ± 1.64	3.52 ± 1.44	3.11 ± 1.32	1.042	0.363
Grade of postoperative midline shift [case (%)]				5.607	0.061
0 score (≤ 5 mm)	2 (50.00)	11 (78.57)	19 (95.00)		
1 score (> 5 mm)	2 (50.00)	3 (21.43)	1 (5.00)		
Status of postoperative ambient cistern [case (%)]				1.129	0.569
0 score (normal)	3 (75.00)	12 (85.71)	14 (70.00)		
1 score (compressed)	1 (25.00)	2 (14.29)	6 (30.00)		
2 score (disappeared)	0 (0.00)	0 (0.00)	0 (0.00)		

2. 血肿最大径>8~10 cm 由于血肿最大径>8~9 cm和>9~10 cm的患者均采用5 cm小骨窗开颅血肿清除术，故将此两种情况合并，表3结果显示，3 cm小骨窗、5 cm小骨窗和常规骨瓣开颅血肿清除术患者血肿清除范围（$P = 0.000$）、残留血肿量（$P = 0.000$）、手术时间（$P = 0.000$）、术中出血量（$P = 0.000$）差异有统计学意义，而中线移位、术后中线移位评分和环池评分差异无统计学意义（均$P > 0.05$）。其中，与常规骨瓣组相比，5 cm小骨窗组血肿清除范围小（$t = -4.248$，$P = 0.002$）、残留血肿量少（$t = -2.083$，$P = 0.041$）、手术时间短（$t = -10.715$，$P = 0.000$）、术中出血量少（$t = -10.828$，$P = 0.000$）；3 cm小骨窗组虽也获得可靠的环池结构复现，但手术时间（$t = -1.722$，$P = 0.090$）和术中出血量（$t = -1.504$，$P = 0.137$）与常规骨瓣组差异无统计学意义。提示血肿最大径>8~10 cm时最适宜采用5 cm小骨窗开颅血肿清除术。

3. 血肿最大径>10 cm 当血肿最大径>10 cm时，由表4可见，3 cm小骨窗、5 cm小骨窗和常规骨瓣开颅血肿清除术患者血肿清除范围（$P = 0.000$）、残留血肿量（$P = 0.000$）和手术时间（$P = 0.012$）差异有统计学意义，而术中出血量、中线移位、术后中线移位评分和环池评分差异无统计学意义（均$P > 0.05$）。其中，与常规骨瓣组相比，5 cm小骨窗组血



EDH, epidural hematoma, 硬膜外血种

图4　骨窗缘可操作视角与骨窗大小、血肿最大径和血肿厚度之间的关系

Figure 4　The relationship between operable angle on the edge of craniotomy defect and size of craniotomy defect, EDH maximal diameter, EDH thickness.

肿清除范围小(t = - 3.125, P = 0.003)、手术时间短(t = - 2.948, P = 0.006)，但残留血肿量增加(t = 3.478, P = 0.001)；而3 cm小骨窗组未显示出任何优势(均P > 0.05)。提示血肿最大径 > 10 cm时最适宜采用常规骨瓣开颅血肿清除术。

三、骨窗大小对骨窗缘可操作视角的限制

在血肿边缘进行清除、悬吊、止血等操作时，手术难易程度还可以骨窗缘可操作视角作为客观评价依据(图4)。Spearman秩相关分析显示，骨窗缘可操作视角与骨窗大小(r_s = 0.330, P = 0.000)和血肿最大径(r_s = 0.177, P = 0.003)呈正相关，而与血肿厚度呈负相关(r_s = - 0.678, P = 0.000)，表明血肿最大径越长、厚度越小，采取小骨窗开颅时骨窗缘可操作视角越小、手术难度越大。

讨　论

急性硬膜外血肿占外伤性颅内血肿的21.5%～50.0%[3]，是神经外科常见急症，及时有效地清除血肿可使大多数患者预后良好[3-4]。常规骨瓣开颅血肿清除术术野显露充分，有利于彻底清除血肿、悬吊和止血，对硬脑膜下隙的探查也较方便，但存在手术创伤大、手术时间延长、术中出血量多、手术相关感染风险增加等缺点[5]；而小骨窗开颅血肿清除术手术创伤小、恢复迅速、头皮切口美观，并可显著缩短手术时间、减少术中出血量和术后并发症，不足之处在于手术悬吊存在一定困难、术后残留血肿量有所增加[2]，部分患者因血肿残留过多导致术后颅内高压不能完全缓解，甚至发生继发性脑损伤，增加病残率和病死率[6]。此外，常规骨瓣开颅过程中颅内压变化较小骨窗开颅明显，患者易出现再灌注水肿，脑出血发生率也相应增加[7-8]。

两种术式各有利弊，随着微创神经外科理念获得广泛认可，临床医师逐渐开始对未出现脑疝或仅早期脑疝形成的无需去骨瓣减压术的急性硬膜外血肿在严格评估的基础上实施小骨窗开颅血肿清除术[9]。然而究竟何种血肿适宜常规骨瓣开颅，何种血肿适宜小骨窗开颅，采取小骨窗开颅时铣开骨瓣的大小等，尚无统一认识。本研究对上述问题进行初步探讨，结果显示，急性幕上硬膜外血肿最大径 ≤ 8 cm时，3cm小骨窗开颅较为适宜，根据我们的临床经验，小骨窗的选择还与术者经验和血肿量有关，血肿量 ≤ 50 ml者可选择3 cm小骨窗开颅、> 50 ml者可选择5 cm小骨窗开颅；血肿最大径 > 8～10 cm时，5 cm小骨窗开颅较为适宜；血肿最大径 > 10 cm时，常规骨瓣(骨瓣长径 ≥ 6 cm)开颅为首选。

由此可见，小骨窗开颅血肿清除术的优点并非一成不变。对于血肿最大径 ≤ 10 cm的急性硬膜外血肿，可以选择3～5 cm小骨窗开颅，从而更好地设计头皮切口，明显缩短手术时间和减少术中出血量过大导致的损伤。然而随着血肿最大径的增加，小骨窗开颅对脑深部血肿清除、悬吊、止血、硬脑膜下探查等的操作难度也逐渐增加，消耗术者不必要的

手术精力，反而延长手术时间和增加手术相关损伤，使“优势”转变成“劣势”。此时，选择常规骨瓣开颅则能够使血肿清除范围更广、残留血肿量更小，尽管手术时间和术中出血量略有增加，但手术质量得到充分保证。

我们的临床经验是，实施5 cm小骨窗开颅血肿清除术时，“S”形头皮切口比直切口在操作上更方便、美观，相当于2个小的弧形皮瓣，通过鱼钩两侧对等牵拉或颅后窝撑开器撑开皮瓣后可有效显露颅骨，一般长度约6 cm、宽度约3 cm的“S”形切口足以显露直径约6 cm的颅骨，因此，在条件许可的情况下，除传统的“∩”形或“?”形头皮切口外，部分常规骨瓣也选择“S”形头皮切口，有利于设计美容切口、缩短切口长度、减小手术创伤。

综上所述，小骨窗开颅血肿清除术基于微创神经外科理念，以去骨瓣减压术为基础进行改进，设计一个路径短、手术创伤小的切口[10]，在充分评估患者病情严重程度和血肿特征的基础上，合理选择手术切口和骨瓣大小，既可有效清除血肿、解除压迫[11]，又可最大限度地减少手术并发症、改善患者预后。

参 考 文 献

[1] Shen J, Pan JW, Fan ZX, Zhou YQ, Chen Z, Zhan RY. Surgery for contralateral acute epidural hematoma following acute subdural hematoma evacuation: five new cases and a short literature review. Acta Neurochir (Wien), 2013, 155:335-341.

[2] Hu LS, Wang WH, Yu YG, Lin JM, Huang W, Li J, Luo F, Zhang Y. Surgical evacuation of acute epidural haematomas: small-window craniotomy vs. rountine craniotomy. Zhongguo Lin Chuang Shen Jing Wai Ke Za Zhi, 2013, 18:146-148.[胡连水, 王文浩, 郁毅刚, 林俊明, 黄巍, 李君, 罗飞, 张源. 小骨窗开颅清除硬膜外血肿. 中国临床神经外科杂志, 2013, 18:146-148.]

[3] Leitgeb J, Mauritz W, Brazinova A, Wilbacher I. Outcome after severe brain trauma associated with epidural hematoma. Arch Orthop Trauma Surg, 2013, 133:199-207.

[4] Klemenc-Ketis Z, Bacovnik-Jansa U, Ogorevc M, Kersnik J. Outcome predictors of Glasgow Outcome Scale score in patients with severe traumatic brain injury. Ulus Travma Acil Cerrahi Derg, 2011, 17:509-515.

[5] Wang HJ. Comparative analyses on the therapeutic effect of cerebral hemorrhage between traditional craniotomy and minimally invasive minicraniotomy. Zhong Wai Yi Liao, 2013, 32:78-79.[王宏江. 小骨窗微创手术与传统手术治疗脑出血疗效分析比较. 中外医疗, 2013, 32:78-79.]

[6] Fei Z, Chao XD. Evidence-based medical study to enhance secondary brain injury factors. Jie Fang Jun Yi Xue Za Zhi, 2012, 37:90-93.[费舟, 晁晓东. 加强二次脑损伤因素的循证医学研究. 解放军医学杂志, 2012, 37:90-93.]

[7] Nakumura T, Xi G, Hua Y, Schallert T, Hoff JT, Keep RF. Intracerebral hemorrhage in mice: model characterization and application for genetically modified mice. J Cereb Blood Flow Metab, 2004, 24:487-494.

[8] Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, Servadei F, Walters BC, Wilberger JE; Surgical Management of Traumatic Brain Injury Author Group. Surgical management of acute epidural hematomas. Neurosurgery, 2006, 58(3 Suppl):7-15.

[9] Hu LS, Wang WH, Lin H, Yu YG, Li J, Huang W, Lin JM, Luo F. Secondary massive cerebral infarction after removal of acute epidural hematoma: multivariate Logistic regression analysis of risk factor. Zhonghua Shen Jing Ji Bing Yan Jiu Za Zhi, 2014, 13:31-35.[胡连水, 王文浩, 林洪, 郁毅刚, 李君, 黄巍, 林俊明, 罗飞. 急性硬膜外血肿清除术后继发大面积脑梗塞的多因素Logistic成因分析. 中华神经疾病研究杂志, 2014, 13:31-35.]

[10] Wu PJ, Li SL, Liu W, Liu XM. Microsurgical anatomy of small bone flap craniotomy through lateral fissure approach. Zhongguo Lin Chuang Shen Jing Wai Ke Za Zhi, 2013, 18:422-424.[吴鹏杰, 李胜利, 刘伟, 刘显明. 小骨窗-外侧裂手术入路的解剖研究. 中国临床神经外科杂志, 2013, 18:422-424.]

[11] Hu LS, Wang WH, Lin H, Lin JM, Li J, Luo F, Zhang Y. The clinical efficacy of small-window craniotomy on non-progressive trans-sinus epidural hematoma. Zhongguo Xian Dai Shen Jing Ji Bing Za Zhi, 2015, 15:142-147.[胡连水, 王文浩, 林洪, 林俊明, 李君, 罗飞, 张源. 小骨窗开颅治疗非进展性跨窦硬膜外血肿. 中国现代神经疾病杂志, 2015, 15:142-147.]

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