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PEEP 对骨肿瘤手术患者全身麻醉期呼吸功能和血流动力学的影响

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摘要 目的:探讨呼气末正压通气(PEEP)对骨肿瘤手术患者全身麻醉期呼吸功能和血流动力学的影响。**方法**:选取 2014 年 1 月-2015 年 12 月期间我院收治的 60 例骨肿瘤患者,所有患者给予常规麻醉诱导后连接呼吸机行机械通气,观察并记录不同 PEEP 通气(0 cm H_2O,5 cm H_2O 和 10 cm H_2O)下呼吸功能及血流动力学指标。**结果**:PEEP 10 cm H_2O 通气水平的气道峰压(Peak)、气道平台压 (Plat) 显著高于 PEEP 5 cm H_2O 和 PEEP 0 cm H_2O 通气,PEEP 5 cm H_2O 通气水平的 Ppeak 和 Pplat 显著高于 PEEP 0 cm H_2O 通气,差异均有统计学意义(P＜0.05);不同 PEEP 通气水平的心率(HR)、平均动脉压(MAP)和中心静脉压(CVP)比较差异无统计学意义(P＞0.05);不同 PEEP 通气水平的心脏指数(CI)、每搏指数(SVI)、全心射血分数(GEF)、心脏功能指数(CFI)、每搏变异度(SVV)、脉压变异率(PPV)、胸腔内血容量指数(ITBI)、血管外肺水指数(ELWI)和肺血管通透性指数(PVPI)比较差异无统计学意义(P＞0.05)。**结论**:增加 PEEP 通气值能够显著改善吸功能的 Ppeak 和 Ppla 指标,但不影响血流动力学指标,值得临床推广应用。

关键词:呼气末正压通气;骨肿瘤;全身麻醉;呼吸功能;血流动力学

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Effects of PEEP on Respiratory Function and Hemodynamics During General Anesthesia in Patients With Bone Tumor Surgery

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ABSTRACT Objective: To investigate effects of PEEP ventilation on respiratory function and hemodynamics during general anesthesia in patients with bone tumor surgery. **Methods:** 60 cases of patients with bone tumors were selected during January 2014 to 2015 December in our hospital, all patients were treated with routine anesthesia induction underwent mechanical ventilation, to observe and record the respiratory function and hemodynamic parameters under different PEEP ventilation (0 cm H_2O,5 cm H_2O and 10 cm H_2O). **Results:** Peak and Plat of PEEP 10 cm H_2O were significantly higher than that of PEEP 5 cm H_2O and PEEP 0 cm H_2O, Peak and Plat of PEEP 5 cm H_2O were significantly higher than PEEP 0 cm H_2O, the difference was statistically significant (P<0.05). The difference of HR, MAP and CVP of different PEEP levels were no statistical significance (P> 0.05). The difference of CI, SVI, GEF, CFI, SVV, PVV, ITBI, ELWI and PVPI of different PEEP levels were no statistical significance(P>0.05). **Conclusion:** Increased PEEP values can significantly improve the absorption function such as Peak and Plat, but no influence on hemodynamic, which is worthy of clinical application.

Key words: Positive end expiratory pressure; Bone tumor; General anesthesia; Respiratory function; Hemodynamics

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前言

目前骨肿瘤患者选择手术治疗的比例越来越高,手术过程多采用全身麻醉,且创伤大、失血多[1,2],且可能对患者的心肺功能产生一些不良影响,如腹内压的增加可能导致肺不张的发生[3],因此,在骨肿瘤患者手术过程中维持正常呼吸功能、如何最大程度减少对心肺功能影响成为关注的热点[4]。呼气末正压通气(positive end expiratory pressure,PEEP)为机械呼吸机在吸气相产生正压,气体进入肺部,在呼气末气道开放时,气道压力仍保持高于大气压,其能够增加呼气末时气道及肺泡气压,张开萎陷的气道和肺泡,使其气体交换功能恢复,进而改善氧合,预防肺部并发症的发生[5],现已广泛应用于临床[6]。但 PEEP 在骨肿瘤手术中的应用效果研究较少[7],本研究据此展开,探讨 PEEP 对骨肿瘤手术患者全身麻醉期血流动力学的影响现报道如下。

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1 资料和方法

1.1 一般资料

选取 2014 年 1 月 -2015 年 12 月期间我院收治的 60 例骨肿瘤患者, 所有患者经诊断确诊为骨肿瘤患者, 其中男性 34 例,女性 26 例,年龄范围 45-67 岁,平均年龄(58.8± 7.3)岁,美国麻醉师协会(ASA)分级:I 级 37 例,Ⅱ级 23 例。入组标准:(1)18-80 岁;(2)体质指数(BMI)18-30 kg/m^2。排除股动脉穿刺置管禁忌、明确的心律失常、合并心、肺、肝、肾功能病的患者。本研究经医院伦理委员会讨论后通过,所有患者知情后签署知

情同意书。

1.2 研究方法

患者入手术室后给予全麻诱导，按计量给予静注丙泊酚、芬太尼或舒芬太尼、罗库溴铵后快速诱导插管。麻醉后持续给予 0.4-1%的异氟醚吸入，并微量泵持续输注丙泊酚和瑞芬太尼。麻醉诱导后行 PEEP 机械通气，设置吸氧浓度 100%，呼吸频率 18 次 /min，吸气和呼气时间比为 1:2，待循环和容量状态稳定后，增加 PEEP 值水平，分别为 0, 5, 10 cm H_2O，每次更改 PEEP 值后稳定 10-15 min。

1.3 观察指标

采用动脉血气分析检测不同 PEEP 值水平的血氧分压（PaO_2）、二氧化碳分压（$PaCO_2$）、气道峰压(Peak)、气道平台压(Plat)和肺顺应性(LC)、心率(HR)、平均动脉压(MAP)和中心静脉压(CVP)。采用脉搏指数连续心输出量监测(PiCCO)仪测定心脏指数(CI)、每搏指数(SVI)、全心射血分数(GEF)、心脏功能指数(CFI)、每搏变异度（SVV）、脉压变异率(PPV)、胸腔内血容量指数（ITBI）、血管外肺水指数（ELWI）和肺血管通透性指数(PVPI)。

1.4 统计学方法

使用 SPSS 17.0 统计软件进行统计学分析，计量资料以均数± 标准差（$\bar{x}\pm s$）表示，两组间比较采用 t 检验，3 组间比较采用方差检验，P＜0.05 为差异有统计学意义。

2 结果

2.1 不同 PEEP 通气下呼吸功能指标变化的影响

PEEP 10 cm H_2O 通气水平的 Peak 和 Plat 显著高于 PEEP 5 cm H_2O 和 PEEP 0 cm H_2O 通气，PEEP 5 cm H_2O 通气水平的 Peak 和 Plat 显著高于 PEEP 0 cm H_2O 通气，差异有统计学意义（P＜0.05），不同 PEEP 通气水平的 PO_2、PCO_2 和 LC 比较差异无统计学意义（P＞0.05），见表 1。

表 1 不同 PEEP 通气下呼吸功能指标变化的影响

Table 1 Effects of different PEEP ventilation on respiratory function indexes

Groups	n	PaO_2（mmHg）	PCO_2（mmHg）	Peak（cm H_2O）	Plat（cm H_2O）	LC（mL/Hg）
PEEP 0 cm H_2O	60	528.2± 62.1	40. 2± 5.3	16.2± 1.2	16.1± 1.4	38.9± 4.2
PEEP 5 cm H_2O	60	538.4± 72.3	41. 0± 5.1	21.3± 1.6*	20.4± 1.6*	37.5± 4.1
PEEP 10 cm H_2O	60	548.2± 68.1	40. 8± 5.2	25.6± 1.9*#	24.3± 1.7*#	39.2± 4.4
F		1.312	0.385	523.758	379.028	2.754
P		0.272	0.681	0.000	0.000	0.066

Note: Compared with PEEP 0 cm H_2O, *P＜0.05; Compared with PEEP 5 cm H_2O, #P＜0.05.

2.2 不同 PEEP 通气下 HR、MAP 和 CVP 变化的影响

不同 PEEP 通气水平的 HR、MAP 和 CVP 比较差异无统计学意义（P＞0.05），见表 2。

表 2 不同 PEEP 通气下 HR, MAP 和 CVP 变化的影响

Table 2 Effects of different PEEP ventilation on the changes of HR, MAP and CVP

Groups	n	HR（Time/min）	MAP（mmHg）	CVP（cm H_2O）
PEEP 0 cm H_2O	60	71.3± 14.9	85.3± 13.2	7.8± 2.1
PEEP 5 cm H_2O	60	69.4± 13.8	84.3± 13.1	8.0± 1.9
PEEP 10 cm H_2O	60	68.3± 12.5	79.9± 10.4	8.2± 2.5
F		0.729	2.900	0.505
P		0.484	0.058	0.605

2.3 不同 PEEP 通气下 PiCCO 监测指标变化的影响

不同 PEEP 通气水平的 CI、SVI、GEF、CFI、SVV、PPV、ITBI、ELWI 和 PVPI 比较差异无统计学意义（P＞0.05），见表 3。

表 3 不同 PEEP 通气下 PiCCO 监测指标变化的影响

Table 3 Effect of PiCCO monitoring indexes under different PEEP ventilation

Groups	n	CI (L/min/m²)	SVI (mL/m²)	GEF(%)	CFI(L/min)	SVV(%)	PPV(%)	ITBI(mL/m²)	ELWI (mL/kg)	PVPI(%)
PEEP 0 cm H_2O	60	2.63± 0.56	38.1± 6.1	28.1± 5.3	4.9± 1.5	8.3± 2.3	6.3± 2.0	718.3± 132.1	6.7± 2.1	1.7± 0.8
PEEP 5 cm H_2O	60	2.53± 0.59	37.5± 6.5	27.4± 5.4	4.5± 1.2	8.5± 2.1	6.2± 2.1	722.3± 112.4	6.3± 2.2	1.5± 0.7
PEEP 10 cm H_2O	60	2.61± 0.46	37.9± 5.4	28.3± 5.6	4.6± 1.2	7.9± 2.2	6.6± 2.3	712.3± 131.3	6.4± 2.3	1.6± 0.8
F		0.852	0.155	0.454	1.520	1.555	0.589	0.096	0.536	1.017
P		0.428	0.857	0.454	0.221	0.317	0.556	0.908	0.586	0.364

3 讨论

骨肿瘤手术创伤大，出血多，且需要进行全身麻醉，易产生手术并发症，尤其是肺不张的发生几率较高，严重者可能导致

肺泡萎陷[8]。肺不张发生的原因可能原因包括麻醉药物引起膈肌和吸气肌张力下降,呼气时可能引起压迫性肺不张,而肺泡气体量的减少也可能引起肺不张[9-11],此外,麻醉过程中肺表面活性物质的减少,也可能引起肺不张。有学者提出 PEEP 通能改善患者肺功能和气体交换,降低肺不张的发生几率[12,13]。

本研究发现,不同 PEEP 通气水平的 PO_2、PCO_2 和 LC 比较差异无统计学意义,表明增加 PEEP 值并不能显著改善 PO_2、PCO_2 和 LC 水平,其可能原因是械通气下吸入的气体已为纯氧,增加 PEEP 值虽然能够改善通气血流比,但血流中溶解氧已接近饱和,PO_2、PCO_2 水平不会因此再增加。而骨肿瘤患者在术前一般不伴有明显的呼吸系统疾病,全麻后使用肌松药能够减少胸廓对肺通气的限制作用[14],因此,不同 PEEP 水平对 LC 的影响不大。本研究结果也发现,增加 PEEP 值能够显著增加 Peak 和 Plat 水平,这与其他研究结果相似[15,16]。本次研究也发现,不同 PEEP 通气水平的 HR、MAP 和 CVP 比较差异无统计学意义,表明不同 PEEP 通气水平对患者的 HR、MAP 和 CVP 无任何影响,但有研究发现,增加 PEEP 值能够引起 CVP 显著升高,且呈显著正相关[17]。其可能原因包括升高的胸内压直接压迫心房和腔静脉、胸外静脉压的大幅升高、右室后负荷增加以及右室功能不全等[18]。

本研究采用 PiCCO 仪监测患者全身麻醉过程中的血流动力学指标,本方法是一种微创血流动力学监测技术,能够采集多种指标,为临床治疗提供参考依据[19]。本研究发现不同 PEEP 通气水平的 CI、SVI、GEF、CFI、SVV、PPV、ITBI、ELWI 和 PVPI 比较差异无统计学意义($P>0.05$),有学者认为 SVV 以及 PPV 等可以作为容量负荷的参考指标,且敏感性、特异性更高[20]。CFI 以及 GEF 能够反映心肌收缩力,ITBI 能够准确准确反映心脏前负荷,本研究结果显示这三项指标均显示正常,表明患者的血流动力学指标并不随 PEEP 水平变化而变化。有研究发现 PEEP 越高,CI 下降越显著,其可能是通过增加肺循环阻力,从而降低 CI。此外,是低水平 PEEP 产生的心肺交互作用很小,对血容量正常或偏高患者的 CI 影响不大[21]。本组患者虽然术前给予禁食禁水,但在麻醉诱导前均给予有效的体液补充,SVV 显示正常,表明患者的容量状态基本正常。

综上所述,增加 PEEP 通气值能够显著改善吸功能的 Peak 和 Plat 指标,但不影响血流动力学指标,值得临床推广应用。

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肿瘤进展有较大关系。相关性分析显示，子宫内膜癌组织GDF-15与p-mTOR蛋白呈正相关关系，与其他研究结果具有相似性[18,19]，提示GDF-15与p-mTOR在子宫内膜癌发生和发展中具有协同作用，GDF-15可能激活mTOR以及其下游的信号通路来促进肿瘤的发生和发展。有动物实验证实[20]，GDF-15可以促进mTOR磷酸化，进而提高mTOR促进细胞分裂增殖作用。

综上所述，子宫内膜癌组织中会出现GDF-15和p-mTOR阳性表达率升高，且与肿瘤进展有较大关系，GDF-15与p-mTOR存在正相关关系，GDF-15可以通过调节mTOR通路来促进肿瘤的发生和发展。

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