A Survey of Perioperative Vascular Complications in Non-Cardiovascular Surgery in a Teaching Hospital in Western China

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HU ET AL.: ***A Survey of Perioperative Vascular Complications in Non-Cardiovascular Surgery in a Teaching Hospital in Western China. Introduction:*** *Perioperative period particularly in the elderly is associated with unstable circulatory status, depending on patients' baseline conditions, anesthetic techniques and medications, as well as types of surgical procedures.* ***Objective:*** *To study the characteristics and risk factors of perioperative cardiovascular, cerebrovascular and renovascular complications in patients ≥50 years undergoing non-cardiovascular abdominal and lower limb operations.* ***Methods:*** *Retrospective review of hospital records of 1975 patients operated in the period from January 2004 to June 2005, taken from our hospital archive.* ***Results:*** *Their mean age was 63.1±10.1 years and 44.4% were male. There were 1121 perioperative complications, including acute hypertension (576), arrhythmias (sinus tachycardia, atrio-ventricular block, atrial fribrillation, ventricular fibrillation) (455), acute renal insufficiency (32), coronary artery disease (56) and stroke (2). Nineteen patients (1%) died of multiple organ dysfunction syndrome. The incidence of perioperative complications increased with age. Analgesics were given to 958 patients (48.5%) in postoperative period for pain control. The incidence of perioperative arrhythmias and coronary artery disease in analgesic group was higher than non-analgesic group (p<0.01).* ***Conclusion:*** *Perioperative vascular complications of patients (particularly in the elderly) are common. More vigilant perioperative evaluation and more efficient perioperative pain control are needed. (J HK Coll Cardiol 2006;14:53-56)*

Cardiovascular event, cerebrovascular event, perioperative complications analysis, renovascular event

摘要

引言：圍手術期病人，尤其是老年人，由於每個病人的基礎狀況、麻醉技術、用藥、以及手術種類不相同而常常伴隨各種不穩定循環狀態。**目的：**研究圍手術期中年齡等於或大於５０歲病人，在施行非心血管的腹部和下肢手術中心血管、腦血管和腎血管併發症發生的危險因素。方法：回顧性分析自2004年1月至2005年6月期間醫院檔案中1975例手術病人的住院紀錄。**結果：**病人平均年齡爲63.1±10.1歲，44.4%爲男性。在圍手術期中有1121例併發症，包括急性高血壓（５７６例），心律失常（竇性心動過速、房室傳導阻滯、房顫、室顫，共４５５例），急性腎功能不全（32例）、冠心病（56例）和中風（2例）。19例病人（1%）死於多器官功能衰竭。圍手術期併發症發生率的上升與年齡相關。958例病人（48.5%）在術後需給服鎮痛劑止痛。手術期後需服用鎮痛劑組病人中，心律失常和冠心病的發生率高於不服用鎮痛劑組病人（Ｐ＜０.０１）。**結論：**圍手術期中病人（尤其是老年病人）心血管併發症相當常見。有關人員需要更嚴謹的評估圍手術期併發症的風險和更有效的控制手術後疼痛。

關鍵詞：心血管事件　腦血管事件　圍手術期併發症分析　腎血管事件

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Introduction

Anesthesia and surgical procedure are harmful stimuli to body; even surgeries causing small external wounds can result in unstable circulatory status, various complications and even death. Perioperative period particularly in the elderly is associated with more

circulatory instability, depending on patients' baseline conditions, anesthetic technique and as well as types of surgical procedures.

Patients and Methods

Subjects

1975 patients (≥50 years) undergoing non-cardiovascular operations in abdominal and lower limb regions in the period from January 2004 to June 2005 were studied retrospectively. Their clinical histories and other data were taken from our hospital archive.

Surgery Category and Anesthesia Mode

According to the guidelines of the American College of Cardiology/American Heart Association (ACC/AHA) for perioperative cardiovascular evaluation for noncardiac surgery, 488 patients had high risk surgeries, 1058 patients intermediate risk surgeries and 429 patients had low risk surgeries. General anesthesia were administered in 1108 patients, epidural anesthesia in 454 patients, epidural-lumbar anesthesia in 179 patients, and lumbar anesthesia in 234 patients.

Study Outcomes and Statistical Analysis

Perioperative acute hypertension (acute HT) was defined as blood pressures being normal before operation, but increased by more than 20% and higher than 140/90 mmHg during or after operation. Acute renal insufficiency (acute RI) was defined as the serum creatinine increased by ≥44.2 μmol/L per day.

Significance of differences in proportions across groups was assessed by χ^2 statistics (χ^2 test). Statistical significance was inferred at 2-tailed value of $P<0.05$.

Results

Baseline Characteristics

Males were 44.4% (877 cases), females were 55.6% (1098 cases). Their age ranged from 50 to 99 years, with mean age of 63.1 ± 10.1 years. Age groups were: 50~59 years in 44.5% (878 cases), 60~69 years 27.4% (541 cases), 70~79 years 20.9% (413 cases) and ≥80 years in 7.2% (143 cases). Preexisting medical problems were prevalent, including hypertension 16.6% (327 cases), coronary artery disease (CAD) 4.9% (97 cases), cerebral infarction 1.8% (36 cases), arrhythmias 1.1% (22 cases), diabetes mellitus 6.7% (132 cases), and heart failure 1.3% (26 cases).

Perioperative Complications

There were 1121 perioperative complications, including acute HT (576), arrhythmias (sinus tachycardia, atrio-ventricular block, atrial fibrillation, ventricular fibrillation) (455), acute RI (32), CAD (56) and stroke (2). Nineteen patients (1%) died of multiple organ dysfunction syndrome. The incidence of perioperative complications increased progressively with age (Table 1). Among these 576 patients complicated by HT, 161 also had additional arrhythmia, 7 acute RI, and 14 had coronary events.

Pain Therapy

Analgesics were given to 958 patients (48.51%) in postoperative period for pain control. The incidence

Table 1. Complications according to age groups

	50-59 yrs (n=878)	60-69 yrs (n=542)	70-79 yrs (n=413)	≥80 yrs (n=142)	p-value
Acute HT	31.2%	44.8%	58.0%	58.5%	<0.001
Arrhythmia	21.3%	0.3%	26.9%	33.1%	0.002
CAD	1.4%	2.8%	4.4%	7.6%	<0.001
Acute RI	0.9%	0.7%	3.2%	4.9%	<0.001
Mortality	0.3%	0.7%	1.9%	2.8%	0.004

HT: Hypertension; CAD: Coronary Artery Disease; RI: Renal Insufficiency

of postoperative arrhythmias and CAD in analgesic group (64.0%) was higher than that in non-analgesic group (49.8%) ($p<0.01$) (Table 2).

Discussion

Perioperative vascular complications in non-cardiovascular surgery over an 18 months' period in 2004/05 in our teaching hospital in western China is rather common.

Reasons for Postoperative Cardio-, Cerebro-, and Renovascular Events

There were 576 patients developing acute HT, 66 of them had hypertension before operation. These may be related to painful wounds after wearing out of narcotics, uncomfortable trachea or catheter intubation, hyoxemia or hypercarbia, overtransfusion during or after surgery and bladder distention. These may increase cardiac afterload which can lead to myocardial ischemia, myocardial infarction, arrhythmia, heart failure, hemorrhagic stroke, cerebral ischemia, pulmonary edema, and excessive capillary hemorrhage in operative site.[1] Among these 576 patients complicated by HT, 161 also had additional arrhythmias, 7 acute RI, and 14 coronary events.

There were 56 patients with coronary complications, 18 of them had it before surgery. Perioperative myocardial ischemia and infarction were related to preoperative CAD with vulnerable myocardial blood supply, autonomic activation by pain, psychological stress, anemia and hypothermia, which may tip the balance of myocardial oxygen demand and supply.

Both anesthesia and surgical trauma may cause excessive stress reaction, resulting in sudden fast release of catecholamine. Meanwhile, electrolyte disturbances (hypomagnesemia), acid-base imbalance, hyoxemia, hypercarbia, mechanical irritation and circulatory disturbance may lead to arrhythmias.[2]

Perioperative acute RI is the result of hemodynamic changes, especially hypoperfusion and hypoxia of renal parenchyma, presumably caused by renal artery constriction and blood redistribution.[3] Vasoconstriction in response to hypovolemia, dehydration and intense dehydration may in turn result in transient renal dysfunction in short term, and possibly more permanent parenchymal defect in long term. In addition, the increase of antidiuretic hormone, catecholamine, aldosterone and angiotensin as well as the decrease of atrial natriuretic factor and nitric oxide may cause further renal function changes.

Eighty percent of stroke in China is ischemic and 20% is hemorrhagic. Some studies indicated that the incidence of ischemic stroke in patients with preexisting cerebrovascular disease, chronic obstructive lung disease and peripheral vascular disease was 13 times, 9 times, and 8 times respectively as that of normal people.[4] Perioperative stroke is more prevalent with acute hypertensive episodes complicating underlying cerebrovascular disease and unstable hemodynamics. Efficient control of hypertension in long term can lower the morbidity and mortality of cerebrovascular disease.[5]

Characteristics of Vascular System and Organs in the Aged

The incidence of perioperative cardiovascular complications increase progressively with age. Our findings agree with many previous studies indicating

Table 2. Postoperative complications of analgesic versus non-analgesic groups

	Analgesic group (n=958)	Non-analgesic group (n=1017)	p-value
Acute HT	298 (31.1%)	278 (27.3%)	0.067
Arrhythmia	257 (26.8%)	198 (19.5%)	<0.001
CAD	37 (3.9%)	19 (1.9%)	<0.01
Acute RI	21 (2.2%)	11 (1.1%)	0.073

HT: Hypertension; CAD: Coronary Artery Disease; RI: Renal Insufficiency

that age is one of predictive factors for perioperative cardiovascular events and mortality.[6,7] As age rises, body organs degenerate, functions and functional reserve decrease, while indices of hemorrheology (blood viscosity, hematocrit, RBC deformability) may alter. In particular, the indices of hemorrheology in elderly hypertension, CAD or diabetes mellitus may change more significantly, which directly impair tissue perfusion, and therefore induce hypoxia and vascular dysfunction.[8]

Comparison of the Complications in Analgesic Versus Non-analgesic Groups

The incidence of complications in particular of arrhythmias and coronary events in analgesic group was higher than that of non-analgesic group. Possible explanations may include more unstable clinical profiles, more severe pain, inadequate analgesic dosages and therefore more stress reaction and vascular dysfunction in analgesic group. On the other hand complications may represent the adverse effect of analgesics, but this is rather unlikely.

Nearly every patient may experience some pain after operation, which may lead to anxiety and various complications. In the aged, although the pain threshold may increase, pain perception is associated with more intense emotion and psychological reactions, and the overall pain tolerance is lower than the young.[9] Therefore adequate analgesics, short of inducing respiratory depression or hypotension, should be offered to early postoperative patients and to the elderly in particular.[10]

Summary and Clinical Implications

In postoperative patients overall narcotics, anesthetic technique and surgical procedures may affect physiological stability. In addition other coexisting diseases such as diabetes, CAD and nephropathy, also cause great burden to body. So the functional capacity of patients undergoing non-cardiovascular surgeries should be attended and optimized, and the risk of cardio-, cerebro- and renovascular events fully evaluated before operation. Adequate analgesia and sedation according to clinical status of patient should be offered to decrease postoperative vascular complications in the elderly in particular.

References

1. Haas CE, LeBlanc JM. Acute postoperative hypertension: a review of therapeutic options. Am J Health Syst Pharm 2004; 61:1661-73
2. Ramsay JG. Cardiac management in the ICU. Chest 1999;115 (5 Suppl):138S-144S.
3. Sural S, Sharma RK, Singhal M, et al. Etiology, prognosis, and outcome of post-operative acute renal failure. Ren Fail 2000; 22:87-97.
4. Limburg M, Wijdicks EF, Li H. Ischemic stroke after surgical procedures: clinical features, neuroimaging, and risk factors. Neurology 1998;50:895-901.
5. Barker WH, Mullooly JP, Linton KL. Trends in hypertension prevalence, treatment, and control: in a well-defined older population. Hypertension 1998;31(1 Pt 2):552-9.
6. Cohen G, David TE, Ivanov J, et a1. The impact of age, coronary artery disease, and cardiac comorbidity on late survival after bioprosthetic aortic valve replacement. J Thorac Cardiovasc Surg 1999;117:273-84.
7. Priebe HJ. The aged cardiovascular risk patient. Br J Anaesth 2000;85:763-78.
8. Ajmani RS, Rifkind JM. Hemorheological changes during human aging. Gerontology 1998;44:111-20.
9. Nilgün B, Fatma U, Banu B, et al. Analysis of age and gender related differences in pressure pain threshold and pressure pain tolerance levels. The Pain Clinic 2002;14:309-14.
10. Macintyre PE. Safety and efficacy of patient-controlled analgesia. Br J Anaesth 2001;87:36-46.