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Perioperative haemodynamic changes in patients undergoing laparoscopic adrenalectomy for phaeochromocytomas and other adrenal tumours

C.N. Parnaby [a,*], M.G. Serpell [b], J.M. Connell [c], P.J. O'Dwyer [a]

[a] University Department of Surgery, Western Infirmary, Dumbarton Road, Glasgow G11 6NT, UK
[b] University Department of Anaesthesia, Western Infirmary, Dumbarton Road, Glasgow G11 6NT, UK
[c] University Department of Endocrinology, Western Infirmary, Dumbarton Road, Glasgow G11 6NT, UK

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ABSTRACT

Background: Perioperative haemodynamic changes are well recognised sequelae of adrenalectomy for phaeochromocytomas. The aim of this study was to compare haemodynamic changes in patients undergoing laparoscopic adrenalectomy (LA) for phaeochromocytomas and other adrenal tumours.

Method: Patients were identified from a prospective database (Jan 1999–Feb 2008). All patients were managed by a multi-disciplinary team. Haemodynamic variables were: pulse, blood pressure and the requirement of antihypertensive or vasopressor therapies in the perioperative period.

Results: Over the nine-year period, 34 consecutive patients underwent laparoscopic phaeochromocytoma resection (one patient had delayed contralateral LA) and 104 consecutive patients underwent LA for other tumours (two patients had delayed contralateral LA). 5 out of 35 resections in the phaeochromocytoma group experienced severe hypertension (systolic blood pressure (SBP) >200 mm Hg) compared to two out of 106 resections in the non phaeochromocytoma group ($p = 0.010$). No patient in either group had a transient or persistent (>10 min) SBP >220 mm Hg. Intraoperative antihypertensive use was significantly increased in the phaeochromocytoma group ($p < 0.005$). There were no significant differences between groups for persistent hypotension (SBP <80 mm Hg), heart rate >120/min and recovery room haemodynamic parameters.

Conclusion: LA for phaeochromocytoma can be accomplished with low perioperative haemodynamic complications when compared to LA for other adrenal tumours.

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Introduction

Laparoscopic adrenalectomy (LA) has become a well established operation for phaeochromocytoma resection and results in improved hospital stay and shorter convalescence when compared to open adrenalectomy.[1–3] However, both pneumoperitoneum and adrenal gland manipulation have been shown to cause a high level of catecholamine release

* *Corresponding author*. 47 Old Edinburgh Road, Inverness IV2 3PG, Scotland, UK. Tel.: +44 7834704560.
E-mail address: craigparnaby@aol.com (C.N. Parnaby).
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during laparoscopic resection.[4,5] This can result in haemodynamic changes in the form of severe hypertension (systolic blood pressure (SBP) >200 mm Hg) and cardiac arrhythmias.[6,7] Subsequent removal of the adrenal gland results in a marked decrease in catecholamines and can induce hypotension, which may be refractory to fluid or alpha agonist therapy.[8]

A number of studies have documented the perioperative haemodynamic changes during phaeochromocytoma resection using a variety of regimens to control arterial blood pressure.[6,9,10] For example, Kinney et al.,[6] studied 143 patients who received preoperative phenoxybenzamine (a long-acting non selective alpha blocker). Despite this, 20 patients (14%) experienced very severe intraoperative severe SBP >220 mm Hg. Other medications such as calcium antagonists are an alternative to phenoxybenzamine. Lebuffe et al.[9] used preoperative oral nicardipine; 27 out of 105 patients (26%) experienced severe SBP >200 mm Hg, 12% experienced persistent hypotension and 30% experienced a tachycardia (heart rate >120 bpm). However, in both of these studies only 3% and 22% (respectively) of patients underwent a laparoscopic procedure.

In the current series, a phenoxybenzamine regimen was used to control blood pressure for patients undergoing phaeochromocytoma resection. We felt complete alpha blockade was achieved in all cases. Using this regimen and a specialist endocrine, anaesthetic and surgical team the perioperative haemodynamic stability of LA for phaeochromocytoma has improved to such a degree that they may now be comparable to LA for other non-catecholamine secreting adrenal tumours.

A small number of studies have compared the laparoscopic perioperative haemodynamic changes of phaeochromocytoma resection with other adrenal tumours.[11–13] Unfortunately, the numbers tended to be small and the laparoscopic technique was used infrequently.

Therefore, the aim of the present study was to compare the perioperative haemodynamic changes in consecutive patients undergoing LA for phaeochromocytomas and other adrenal tumours during the same period.

Materials and methods

From January 1999 to February 2008, all patients who underwent laparoscopic adrenalectomy were identified from a prospective database and analysis was performed retrospectively. The only contraindications to the laparoscopic approach were radiological locally advanced adrenal tumours requiring en-bloc resection of adjacent organs or the requirement of an additional open procedure.

All adrenal tumours were assessed by an endocrine unit. Adrenal resection was performed by a single surgeon and anaesthetists with experience in phaeochromocytoma resection.

The diagnosis of phaeochromocytoma was based on clinical, biochemical and imaging studies. Clinical presentation included intermittent episodes of palpitations, sweating, headaches and hypertension. Patients from an affected family or with genetic syndromes (eg MEN2 or von Hippel-Lindau) were also screened. Biochemical screening included 24 h urine collection for the measurement of fractionated catecholamines and their metabolites (metanephrines and vanillymandelic acid (VMA)). Localisation of the tumour was by computed tomography (CT) or magnetic resonance imaging (MRI) scans. I-meta-iodo-benzylguanidine (MIBG) nuclear scanning was used to detect metastatic disease or extra-adrenal paraganglioma.

The diagnosis of other adrenal tumours (non phaeochromocytomas) was based on clinical findings and hormonal assessment. Localisation of the tumour was by CT or MRI.

At initial endocrine assessment, all patients with a suspected phaeochromocytoma received oral phenoxybenzamine as the primary alpha blocker (range 10–60 mg/day). This was titrated to achieve a blood pressure measurement <160/90 mm Hg. Patients, who were hypertensive, were often taking other anti-hypertensive medication, usually initiated by the referring physician prior to the diagnosis of phaeochromocytoma. These included beta-blockers, ACE inhibitors, calcium antagonists and loop and thiazide diuretics. Patients were not routinely beta-blocked in the preoperative period. Hypertension was controlled in all phaeochromocytoma patients prior to elective resection. Patients who were hypertensive in the non phaeochromocytoma group received a variety of anti-hypertensives, again dependant on the referring physician, including: beta-blockers, ACE inhibitors, calcium antagonists and loop and thiazide diuretics. Once a diagnosis of Conn's syndrome was made, additional potassium-sparing diuretics were introduced (spironolactone or amiloride).

All patients in the phaeochromocytoma group received an infusion of phenoxybenzamine (1 mg kg^{-1}, a non selective alpha blocker) the day before LA. Oral phenoxybenzamine was discontinued the day before theatre.

Anaesthesia was standardised as follows; induction was with a combination of fentanyl, propofol and a muscle relaxant, and maintenance by volatile agents (isoflurane, sevoflurane) in an air/oxygen mixture and morphine as a bolus or infusion. Arterial blood pressure was monitored either by a radial arterial line or by a non-invasive oscillometric blood pressure cuff (measured every three minutes). Pulse and blood pressure measurements were recorded onto an anaesthetic chart every five minutes. Laparoscopic adrenalectomy was performed using the lateral transabdominal approach.[14] During surgery for phaeochromocytoma, episodes of hypertension (SBP >180 mm Hg) were treated with intravenous phentolamine (boluses 1–2 mg) and/or labetolol (boluses 5–10 mg). Tachycardia was treated with intravenous labetolol (boluses 5–10 mg). Hypotension was treated with fluid boluses (crystalloid or colloid) and/or an intravenous vasopressor (metaraminol).

Preoperative information included age, sex, diagnosis, blood pressure measurement, antihypertensive medication and in the case of phaeochromocytomas the preoperative levels of urinary or plasma catecholamines. Intraoperative information included method of anaesthesia, total anaesthetic time, all pulse and blood pressure recordings, use of anti-hypertensives, use of intravenous fluids or blood products and operative complications. Post operative information included recovery room haemodynamic measurements, the use of vasopressors and the requirement of intensive care admissions.

Severe hypertension was defined as SBP >200 mm Hg.[7,11,15] A transient episode was defined as <10 min and a persistent

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