Eur J Vasc Endovasc Surg (2016) ■, 1–10

Outcome After Open and Laparoscopic Aortic Surgery in Matched Cohorts Using Propensity Score Matching

J.-B. Ricco [a,*], J. Cau [b], F. Biancari [c], M. Desvergnes [a], N. Lefort [a], R. Belmonte [a], F. Schneider [a]

[a] Vascular Surgery Department, University of Poitiers, Poitiers 86021, France
[b] Vascular Surgery Unit, Polyclinique de Poitiers, Poitiers 86000, France
[c] Department of Surgery, Oulu University Hospital, 90210 Oulu, Finland

WHAT THIS PAPER ADDS

This propensity score-matched cohort suggests that even in a well trained laparoscopic surgical group, a laparoscopic approach increases the risk of adverse events observed in the course of aortic surgery. This negative result contrasts with those reported in most observational studies, probably because the propensity score avoids the heterogeneity of the previous studies published on this subject and limits the confounding and selection biases.

Objective/Background: To compare the post-operative and mid-term outcomes of laparoscopic aortic surgery with those of conventional aortic surgery performed by a surgical team trained in laparoscopic aortic surgery.
Methods: A prospective study was conducted between January 2006 and December 2011 with 228 consecutive patients having undergone aortic bypass surgery for either an abdominal aortic aneurysm ($n = 139$) or occlusive aorto-iliac disease ($n = 89$). Conventional open aortic surgery was carried out in 145 patients, and total laparoscopic repair in 83 patients. The composite primary end point measure grouped together the following adverse events (AEs): (1) any deaths < 30 days or later deaths related to the operation; (2) post-operative hemorrhage necessitating reoperation; (3) myocardial infarction ≤ 30 days; (4) stroke ≤ 30 days; (5) post-operative respiratory failure necessitating re-intubation or assisted ventilation ≥ 4 days; (6) aortic prosthesis infection; (7) aortic prosthesis occlusion; (8) any re-operation related to aortic surgery. In order to diminish bias attributable to the absence of randomization, the two surgical groups were matched by a propensity score enabling analysis of 50 pairs of patients having presented with identical pre-operative characteristics. Univariate analysis of the AE occurring during the first 30 post-operative days was followed by multivariate analysis through logistic regression. The rate of AE during follow up was calculated using the Kaplan–Meier method and the roles of the different co-variables were analyzed using the Cox model.
Results: Univariate analysis of the groups adjusted for propensity score showed that laparoscopic repair was associated with a significantly higher risk of AE over the first 30 post-operative days ($p = .03$). Logistic regression analysis showed that laparoscopic aortic technique (odds ratio [OR] 4.50; $p = .01$) and coronary artery disease (OR 4.67; $p = .02$) were independently related to the occurrence of an AE during the post-operative period. The occurrence of AEs during follow up was analyzed using the Cox model. Only two variables, laparoscopic aortic surgery (hazard ratio [HR] 4.40; $p = .002$) and coronary artery disease (HR 2.70, $p = .02$), were independently associated with the occurrence of an AE during follow up. The small number of patients included prevented a separate analysis with regard to aneurysmal and occlusive aortic disease.
Conclusion: This study suggests that even with a well trained surgical team, the laparoscopic approach increases the risk for AEs observed in the course of aortic surgery.
ClinicalTrials.gov Identifier: NCT02325700

Article history: Received 9 December 2015, Accepted 29 February 2016, Available online XXX
Keywords: Aortic surgery, Laparoscopic repair, Laparoscopy, Propensity score

INTRODUCTION

Total laparoscopic aortic surgery aims to achieve results similar to those of conventional aortic surgery while avoiding the physiological stress associated with laparotomy. Europe and Canada have been at the forefront of laparoscopic aortic surgery, its feasibility having been

* Corresponding author.
E-mail address: jbricco2@mac.com (J.-B. Ricco).

http://dx.doi.org/10.1016/j.ejvs.2016.02.021

Please cite this article in press as: Ricco J-B, et al., Outcome After Open and Laparoscopic Aortic Surgery in Matched Cohorts Using Propensity Score Matching, European Journal of Vascular and Endovascular Surgery (2016), http://dx.doi.org/10.1016/j.ejvs.2016.02.021

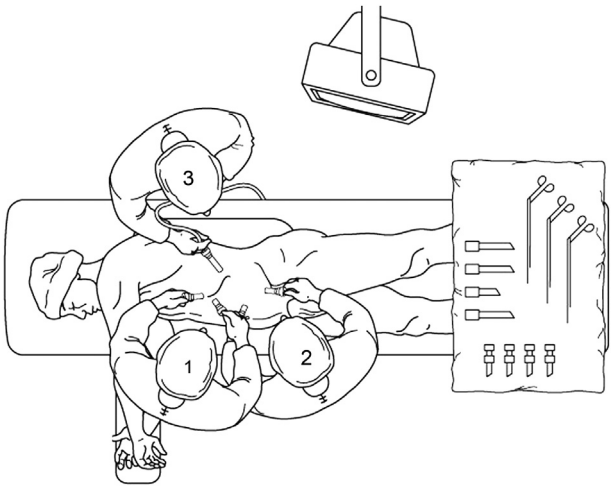

Figure 1. Patient installed in right lateral decubitus for a total laparoscopic retrocolic pre-renal transperitoneal aortic approach. *Note*. 1 = principal operator, 2 = first assistant, 3 = second assistant.

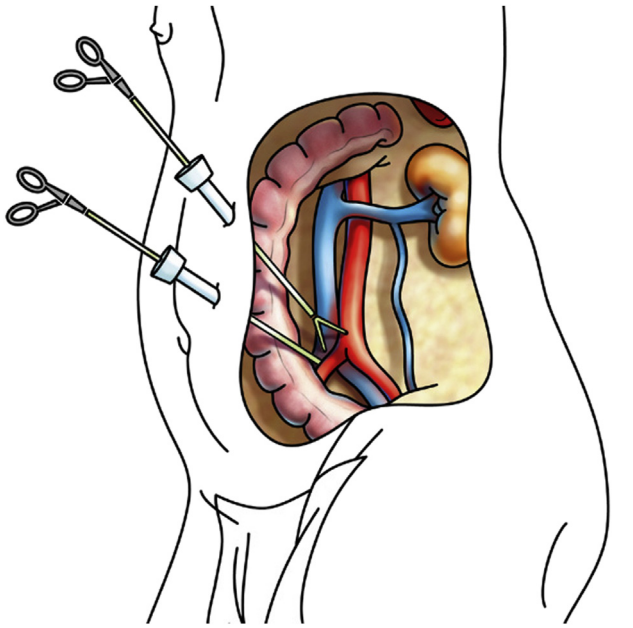

Figure 2. Retrocolic pre-renal aortic approach. The patient is in right lateral decubitus. The small bowel is tilted to the right and displaced by the mesocolon. This approach clears enough space to approach the infrarenal aorta.

demonstrated as early as 1993 by Dion et al.,[1] and subsequently by Coggia et al.[2] Since that date, numerous retrospective studies have been published,[3–6] and yet unlike endovascular aortic techniques, aortic laparoscopy has failed to develop. Given the scarcity of vascular surgeons able to perform laparoscopic aortic repair and the recent advances in endovascular surgery for the treatment of abdominal aortic aneurysms (AAA) and aorto-iliac occlusions, some authors have gone so far as to call into question the place of laparoscopy in these types of indications.[7] However, owing to the current limitations of endovascular treatment,[8] 20—40% of patients with aortic disease are currently treated by open repair. It is in these patients, for whom endovascular treatment is contraindicated, that laparoscopic repair has been suggested as an alternative that would be less invasive than open aortic surgery, reducing post-operative complications and length of hospital stay. This study was conducted to determine the results of laparoscopic aortic surgery and to compare them with those of open aortic surgery by laparotomy.

MATERIALS AND METHODS

Conduct of this prospective study was preceded by a 3 year training period that was validated by the publication in 2006 of a series of 95 patients with aortic disease operated on by a total laparoscopic approach.[9]

Laparoscopic aortic surgery technique

All of the aortic interventions were performed by a total laparoscopic approach that was either retrocolic pre-renal transperitoneal (n = 67 [79%]) or retro-renal (n = 18 [21%]). The laparoscopic aortic technique has been described in detail elsewhere.[10]

In summary, after induction of general anesthesia, the patient is placed in a semi-right lateral decubitus position using an inflated support plate beneath the left flank. The table is then turned to the right at an angle of 45° (Fig. 1). Right lateral decubitus tilts the small bowel and thereby clears the surgical space required for the aortic approach (Fig. 2). The laparoscopic approach to the infrarenal aorta commences with detachment of the left colon down to the left mesocolon flexure. Dissection is then carried out on the anterior aspect of the aorta up to the renal arteries and down to the common iliac arteries.

In cases of aorto-bi-femoral bypass, the approach to the femoral arteries is carried out conventionally. A polyester aortic prosthesis is introduced by one of the trocars. After heparin injection, the aorta is clamped with laparoscopic clamps introduced through the trocars. Aortic end to end or end to side anastomosis is carried out with a polypropylene 3.0 suture that is buttressed at one end with a pledget. The limbs of the prosthesis are then tunneled and femoral anastomoses are carried out in a standard fashion.

In cases of aortic aneurysm, the two iliac arteries are clamped with laparoscopic clamps, the aneurysm is opened, the aortic thrombus is removed from the sac and extracted from the abdomen, and the back bleeding from the lumbar arteries is controlled either prior to opening the aneurysm sac by clips or by prolene 4/0 sutures inserted inside the aneurysmal sac.

Conventional aortic surgery technique

Conventional aortic surgery was carried out by midline or retroperitoneal laparotomy described in other publications.[11] Midline transperitoneal laparotomy was used in 91patients and retroperitoneal laparotomy in 57 patients including 13 obese patients, 32 patients with a juxtarenal

Please cite this article in press as: Ricco J-B, et al., Outcome After Open and Laparoscopic Aortic Surgery in Matched Cohorts Using Propensity Score Matching, European Journal of Vascular and Endovascular Surgery (2016), http://dx.doi.org/10.1016/j.ejvs.2016.02.021