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## Vocal cord paralysis after aortic arch surgery with stent-graft placement, a contemporary method of arch surgery

Proper investigation of vocal cord paralysis (VCP), a frequently encountered complication after aortic arch surgery, has long been neglected. Predictors for VCP after aortic arch surgery have not been considered in detail.<sup>1,2</sup> In our recent report in the *Journal of Vascular Surgery*, we comprehensively reviewed the results of different types and eras of aortic arch surgeries performed in our hospital during 14-year period and reported the clinical features of VCP.<sup>3</sup> This letter presents the results of further analysis of subgroups of patients undergoing the latest technique of aortic arch surgery with open-style stent graft placement and discusses the clinical features of VCP pertinent to this specific category of surgical procedure.<sup>4</sup>

Our review of a consecutive series of 113 patients undergoing this surgery showed that 11 (9.73%) had VCP. Multivariate analysis revealed that (1) chronic dilatation of the aorta at the left subclavian artery and (2) additional stent graft placement or balloon angioplasty for a stenosed aortic-graft were independent risk factors for postoperative VCP (Table).

We identified the first predictor in our previous report. Although this technique of aortic arch surgery almost completely eliminates the need for manipulation to anastomose the aortic graft to the distal aorta, even the most refined and novel techniques of arch surgery have not managed to reduce the postsurgical incidence of VCP to less than one in ten of all patients. In our previous study, we found that pre-existing chronic dilatation was associated with both postoperative and preoperative VCP. We surmise that a left recurrent nerve already chronically affected by preoperative aortic injury would also likely be highly susceptible to minute surgical trauma during operational procedures. In such and similar cases, in particular, it would be extremely difficult to completely avoid collateral trauma to the recurrent laryngeal nerve during surgery.

The newly identified predictor, additional stent grafting or balloon angioplasty, is specifically associated with stent graft placement at the distal part of aortic lesion. In our series, additional stent grafting or balloon angioplasty was commonly performed when the stent graft was kinked around the distal end of stent graft. This suggests that VCP associated with these operative factors may be specific to arch surgery with stent graft placement. In other words, the pathogenesis of this VCP, associated with our current techniques, may be different from that which occurs after conventional aortic surgery.

Any VCP associated with the techniques of arch surgery may be further reduced by refining the surgical techniques. Exactly how additional stent grafting or balloon angioplasty contribute to VCP

**Table.** Independent predictors, derived by logistic regression analysis, of vocal cord paralysis after aortic arch surgery\*

Variables	OR	95% CI	P†
Chronic dilatation of aorta at lt-SCA	14	2.84-107.6	.0029‡
Additional stent graft or balloon angioplasty at stenosed stent graft	39.9	4.2-595.3	.0026‡
CAD	4.75	0.70-32.9	.099

OR, Odds ratio; CI, confidence interval; lt-SCA, left subclavian artery; CAD, coronary artery disease.

\*Results of multivariate logistic regression analysis of variables tested against VCP as independent risk factors. Perioperative factors were subjected to logistic regression analysis to identify independent risk factors for the development of VCP. Perioperative variables with a univariate probability of  $P < .2$  were entered in the initial analysis. All variables with an independent significance level of  $P < .1$  were included in the final model.

†P values derived from multivariate analysis.

‡Statistically significant difference (significance,  $P < .05$ ).

is not known. It is possible, however, that after the placement of an additional stent graft, curvature of the aortic arch around the stenosed stent graft may be deformed, and this may induce dysfunction of the left recurrent laryngeal nerve.

To summarize, even the latest surgical techniques in aortic arch surgery have not eliminated the high risk of surgical VCP. Surgical trauma, along with the dwelling influence of preoperative structures on the recurrent nerve, makes it difficult to eliminate VCP. The other predictor—additional stent graft placement or balloon angioplasty of a stenosed aortic-graft—suggests the possibility of VCP pathogenesis different from conventional methods of aortic surgery.

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