Original Research

Late Clinical Outcomes of Hybrid Catheter Intervention for Acute Massive Pulmonary Thromboembolism

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Abstract

Purpose: We aimed to investigate the long-term outcomes of patients undergoing hybrid catheter intervention for acute massive pulmonary thromboembolism.

Material and Methods: Twenty-five patients with hemodynamic impairment were treated with mechanical thrombus fragmentation, an intrapulmonary injection of mt-PA, and manual clot aspiration between August 1999 and June 2002. All patients were discharged after the procedure. Patients' statuses were checked by medical record examinations and telephone interviews. The median follow-up was 141 months (115-168 months).

Results: Ten patients died during follow-up, five for malignancy, three for septic shock, one for cerebral infarction, and one for heart failure. One patient had recurrence of pulmonary thromboembolism because of drug withdrawal by self-judgment. No chronic pulmonary thromboembolism was observed. The 1-year, 5-year, and 10-year survival rates were 87.5 ± 6.8%, 83.3 ± 7.6%, and 74.5 ± 9.0%, respectively.

Conclusion: Patients who undergo hybrid catheter intervention for acute massive pulmonary thromboembolism show good long-term outcomes.

Key words: Intervention, pulmonary embolism, long-term result

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Introduction

Acute pulmonary thromboembolism (PTE) can be a serious and potential life-threatening condition, and its immediate mortality rate is approximately 10%. Death in patients with acute massive PTE is caused by sudden circulatory collapse because of obstructed pulmonary blood flow. Initial therapy must therefore be directed toward rapidly restoring pulmonary circulation. Conventional therapeutic options are anticoagulation, systemic thrombolysis, and surgical embolectomy. Percutaneous catheter intervention has been introduced in this area, including catheter-directed thrombolysis and catheter-assisted thrombus removal, and provides rapid and safe improvement of the hemodynamic situation in acute massive PTE [1]. However, the late mortality rates associated with this therapy have not yet been reported [2]. Surgical procedure is justified only after the late mortality becomes apparent. Moreover, recurrent PTE and development of chronic thromboembolic pulmonary hypertension are major concerns after acute PTE. This study aimed to retrospectively analyze the late outcomes of hybrid catheter intervention using the previously published materials [3].

Material and Methods

The long-term outcomes of 25 patients with hemodynamic impairment (eight men and 17 women; age range, 35-

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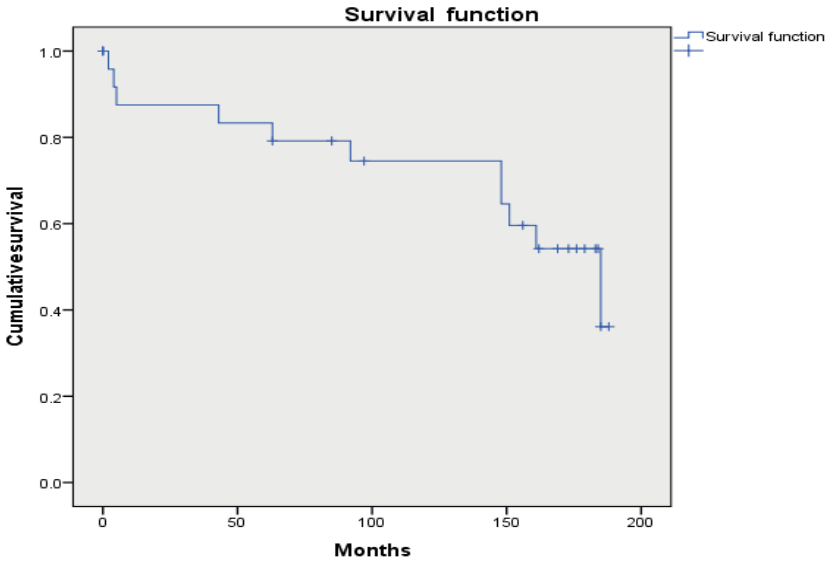

Figure 1. Kaplan-Meier survival curve after hybrid catheter intervention for acute massive pulmonary thromboembolism in all patients. Time shows follow-up in months.

77 years) treated with hybrid catheter intervention (combined use of local thrombolysis, mechanical fragmentation, and aspiration) between August 1999 and June 2002 were retrospectively investigated. For further details, please refer to our previously published report [3]. All patients were discharged after the procedure. We used medical records and telephone interviews to obtain each patient' s status. The diagnosis of chronic thromboembolic pulmonary hypertension was acquired by the ordinary cardiology outpatient service. Overall survivals were assessed using Kaplan-Meier analysis, and all computations were driven by the standard software (Statistical Package for the Social Sciences version 20, International Business Machines Corporation, Armonk, NY, USA), with $p<0.05$ considered significant. This study was approved by the local institutional review board.

Results

The average follow-up was 141 months (115-168 months). Ten patients died during follow-up, five for malignancy, three for septic shock, one for cerebral infarction, and one for heart failure. PTE-related death during the follow-up period was not observed, and one recurrence of PTE because of drug withdrawal by self-judgment was noted. However, chronic PTE was not observed. The 1-year, 5-year, and 10-year survival rates were 87.5 ± 6.8%, 83.3 ± 7.6%, and 74.5 ± 9.0%, respectively, by Kaplan-Mayer survival analysis (**Figure 1**).

Discussion

Hemodynamically unstable massive PTE requires immediate and effective life-supporting therapeutic measures. Based on the guidelines of the American College of Chest Physicians (ACCP) 2016, there were no descriptions about surgical embolectomy. However, in patients with acute PE associated with hypotension and in patients who have (i) high bleeding risk, (ii) who have failed systemic thrombolysis, or (iii) who experience shock that is likely to cause death before systemic thrombolysis can take effect, if appropriate expertise and resources are available, the ACCP suggests a catheter-assisted thrombus resection over no such intervention (Grade 2C) [4].

Patients who undergo surgical pulmonary embolectomy for acute massive PTE have satisfactory early and late outcomes despite being high risk [5-7]. Percutaneous catheter intervention also provides rapid and safe improvement of the hemodynamic situation in acute massive PTE [1], but the late mortality rates associated with this therapy have not yet been reported [1-3].

The long-term outcomes of surgical embolectomy are generally good with acceptable survival rates. The 5- and 10-year survival rates were 87.5% and 83.5% [6, 8], respectively, whereas Vohra et al. revealed an 8-year survival rate of 51.2% [5]. In 2015, Neely collected 115 massive and sub-massive PTE patients and showed that the 3-year survival rates were 65.8% and 80.4%, respectively [9]. In 2019, Mkalaluh et al. reported that the 1-, 5-, and 15-year survival rates were 65%, 63%, and 57%, respectively. The 10-year survival rate was supposed to be approximately 60% [7]. According to our catheter intervention data, the 1-, 5-, and 10-year survival rates were 87.5%, 83.3%, and 74.5%, respectively, which are comparable with the survival rates of surgical embolectomy.

The late deaths in several surgical studies are the result of cancer, which predisposes to the development of PTE [4, 5]. Certainly, we observed five cancer deaths out of 10 in our case series. On the contrary, recurrent PTE and development of chronic thromboembolic pulmonary hypertension are also receiving a lot of attention after acute PTE. In this study,

none of the patients subsequently developed chronic thromboembolic pulmonary hypertension because of incomplete treatment.

The present study had some limitations. This is a retrospective and nonrandomized study that comprises a small sample size. However, catheter intervention for acute massive PTE is an uncommon treatment at most institutions, and case series are significantly important for the evaluation.

In conclusion, hybrid catheter intervention is associated with good late outcomes in a cohort of patients who are critically ill at presentation. The clinical long-term outcomes after surgical embolectomy and catheter-based intervention may be comparable.

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All authors have no conflicts of interest.

The study protocols for this retrospective analysis were approved by our local institutional review board.

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