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Original Research

The beneficial place for the treatment of ruptured abdominal aortic aneurysms

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HIGHLIGHTS

- We study where is the beneficial place for the treatment of ruptured abdominal aortic aneurysms.
- It is beneficial that we treat RAAAs in the diagnosed hospital.
- Treatment of RAAA in diagnosed hospital can avoid the development of unstable state of aneurysm after rupturing from stable state.
- Treatment of RAAA in diagnosed hospital can shorten the time interval from initial symptoms to operation.

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ABSTRACT

Objective: To study the beneficial place for the treatment of ruptured abdominal aortic aneurysms **(RAAAs)**.

Method: A retrospective chart review of consecutive RAAA patients was performed. Patients were divided into two groups: **direct group** and **transfer group**. We retrospectively reviewed patients' hospital charts and recorded various clinical factors apparent on presentation. The primary consequence was mortality during hospitalization, and some other parameters such as duration of intensive care unit (ICU). All patients were followed up at 1 month, 3 months, 6 months and one year after discharge.

Results: During 4-year period, 56 RAAA patients were treated (24 in direct group, and 32 in transfer group). Significant differences were shown for systolic blood pressure, pulse oxygen saturation, hemoglobin, the time interval from diagnosis to operation et al. There was no difference concerning age and comorbidity among two groups. All the patients were treated by open surgical aneurysm repair. The mortality rate was 68.8% ((6 + 16)/32) in transfer group and 33.3% (8/24) in direct group ($P = 0.00067$). Both the duration of ICU stay and entire hospitalization were a bit longer in the transfer group, but there was no significant difference. The mean follow-up time was 25.2 ± 12.9 months. The cumulative survival difference was significant ($P = 0.042$) between the two groups.

Conclusion: It is beneficial that we treat RAAAs in the diagnosed hospital. The reasons are: 1) to avoid the development of unstable state of aneurysm after rupturing of stable state; 2) the time interval from initial symptoms to operation will be shortened.

1. Introduction

Abdominal aortic aneurysm (AAA) is defined as a permanent, localized focal dilation of the abdominal aortic artery with an increase to 1.5 times or more of normal diameter [1]. It occurs more frequently than thoracic aortic aneurysm, and is responsible for approximately 15,000 deaths per year. It accounts for 1.3% of all deaths in men aged from 65 to 85 years in developed countries [2,3]. Despite of prophylactic measures, open surgical repair (OSR) and endovascular aneurysm repair (EVAR) of AAAs have shown to reduce the mortality to 2–6% [4] or even lower than 1.4% [5].Ruptured abdominal aortic aneurysm (RAAA) often is a lethal condition, with an estimated overall mortality rate of 80–90% [6]. One-third of RAAA patients do not reach the hospital alive, and one-third do not have an intervention. Only half of the patients receiving an intervention survive [7]. Despite of advances in operative and perioperative care, the mortality rate of those who survive long enough to undergo an OSR is close to 50% and it has not

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improved over the last decade [8–10]. Efforts to reduce OSR failure, mortality and morbidity associated to it led to the development of minimally invasive EVAR [11]. A number of studies have reported that EVAR is associated with improved post-operative mortality rates as compared to OSR [12,13]. Other studies have suggested that EVAR is not significantly superior to OSR for RAAAs [14–16]. In some reports, regionalization of aneurysm surgery has proven to be advantageous because of decreased mortality rates that is attributed to fully equipped hospitals and specialized vascular surgeons [17]. However many hospitals in developing countries, such as China, do not have facilities and specialized vascular surgeons, to treat RAAA patients despite of being diagnosed. Therefore patients require inter-hospital transfer. During patients' inter-hospital transfer, the intervention speed, method and management of transfer are likely to be critical for improving the mortality rate caused by ruptured aneurysm [18,19]. Transfer can result in a serious delay in life-threatening situations where time is of the essence. It is therefore better for the specialists to go to the hospital in which patients are diagnosed with RAAA to perform an intervention. The purpose of this study is to review our recent experiences with RAAAs and to determine the beneficial place for the treatment of RAAAs.

2. Methods

A retrospective chart review of consecutive RAAA patients (treated by us from March 2010 to March 2014) was performed. The protocol and informed consent were approved by the Nanchang University ethics committee and the relevant Judgement's reference number:20100206. We launched a hospital assistance and call system in our province. Excluded our hospital, other hospitals don't have independent vascular surgery department and specific vascular surgeon. But all of them have the ability to perform general surgery (such as gastrointestinal, hepatobiliary and some other abdominal surgery) and corresponding intensive care unit (ICU). We improve the vascular experience of these peripheral general hospitals and general surgeons via regular salon activities and workshops. Patients were divided into two groups: direct group (those who were treated directly in the hospital where the RAAAs were diagnosed) and transfer group (those who were transferred from another institution for treatment after being diagnosed). The decision for patients' transfer was dependent on the patients' family after being informed about the possible associated risks. Direct group constituted of patients who were diagnosed and treated in our hospital directly, and the patients diagnosed in other hospitals but not transferred, instead treated by our visiting specialized surgeons. We provided the aid of post-operative treatment when the patient was treated in another hospital. On the other hand transfer group comprised of patients referred to and transferred to our hospital for treatment after diagnosis. We included all patients who were confirmed for acute hemorrhage due to abdominal aortic aneurysm, as diagnosed by preoperative imaging such as computer tomography angiography (CTA) or contrast-computer tomography. The patients with ruptured thoraco-abdominal aortic aneurysms were excluded. Patients' hospital charts and recorded clinical factors were retrospectively reviewed. The target parameters were mortality during treatment, the time interval from initial symptoms to operation, total blood transfusion, duration of ICU and hospital stay after surgery. All patients were followed up at 1 month, 3 months, 6 months and one year after being discharged.

2.1. Statistical analysis

The statistical analysis was carried out with the software SPSS (version 19.0; SPSS Inc., Chicago, IL). Means and standard deviations were calculated for quantitative data. Frequencies and percentages were calculated for qualitative data. Proportions were compared with the chi-square test, and means were compared with the Student's *t*-test, with a level of statistical significance of $P < 0.05$. The survival was analyzed with the Kaplan-Meier cumulative.

3. Results

During this 4-year period, 56 RAAA patients were treated in 7 different hospitals and 21 surgeons (9 vascular surgeons in our department, 13 general surgeons in other hospitals) performed the surgeries. There were 40 male and 16 female patients, with a mean age of 63.3 ± 12.3 years (range: 38–84 years). There were 24 patients in the direct group (8 patients in our hospital 16 in other hospitals), and the vascular surgeons took 2.6 ± 1.2 h to reach the hospital by ambulance. While there were 32 patients in the transfer group, and they took 3.8 ± 1.0 h to reach our hospital by ambulance. The comparison of presentation between direct and transfer group is presented in (Table 1**)**. It is shown that there are no differences between the two groups concerning age, abdominal pain and comorbidities. Significant differences are visible for systolic blood pressure (BP), pulse oxygen saturation, hemoglobin and the time interval from initial symptoms to operation. There were six patients who died before the operation in the transfer group. We also found that the life symptoms of the six dead patients were comparatively stable before being transferred. All patients were treated by OSR (Fig. 1). In the transfer group, there were 16 patients who died after operation. Therefore the total mortality rate was 68.8% (6 + 16/32) including the dead patients before operation (Table 2). In the direct group, there were 8 patients who died after operation. So the mortality rate was 33.3% (8/24), which was significantly lower than the transfer group (Table 2). The mortality rate difference between the two groups was also significant if we excluded the dead patients before operation in the transfer group (16/26 vs 8/24, $P = 0.04611$). But, there was no difference in mortality rate between our hospital and other hospitals (2/8 vs 6/16, $P = 0.54$) in the direct group. Both the length of ICU stay and entire hospitalization were a little longer in the transfer group, but there was no significant difference between two groups (Table 2).

The mean follow-up period for all surviving patients was (25.2 ± 12.9) months. The Kaplan-Meier cumulative survival between the two groups was found to be significantly different ($P = 0.042$) (Fig. 2).

4. Discussion

With the advancement of radiology, the diagnosis of arterial diseases has become less difficult. However, many people experience few symptoms of AAA, such as abdominal pain, claudication, and loss of consciousness, until they reach the event of rupture [3]. After rupture, the mortality of AAA patients usually becomes very high [6]. Despite of several advances in diagnostic imaging as well as intraoperative and postoperative critical care, the postoperative mortality rate of RAAA is reportedly high i.e 40–50% [8,9,20,21]. It has not been substantially overcomed for the last two decades [8,9]. Furthermore, the postoperative 30-day mortality rates of RAAA have been reported to be 41.2% [8] and 53% [9]. These results are similar to the recent findings of meta-analysis where 49% of postoperative mortality rate has been reported [10]. They concluded that there has been no significant change in the mortality rates of RAAA over the last 15 years, despite of advancement in diagnostic and treatment. In this study, we observed the similar results, with the overall mortality rate of 53.6% (30/56). So improving the survival of RAAA is still a challenge for our vascular surgeons.