Clinical outcomes of endovascular aneurysm repair of abdominal aortic aneurysm complicated with hypertension: A 5-year experience

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ABSTRACT
Objective: To evaluate the therapeutic effects of endovascular aneurysm repair (EVAR) on abdominal aortic aneurysm (AAA) complicated with hypertension.
Methods: Fifty-two patients with AAA complicated with hypertension treated in our hospital were retrospectively analyzed. They were divided into an observation group (34 cases) and a control group (18 cases). The control group was treated by incision of AAA and artificial blood vessel replacement, and the observation group was treated by EVAR.
Results: All surgeries were performed successfully. However, compared with the control group, the observation group had significantly less surgical time, intraoperative blood loss and blood transfusion, as well as significantly higher total hospitalization expense (P<0.05). During the one-month follow-up, the observation group was significantly less prone to pulmonary infection, surgical site infection, lower-extremity deep venous thrombosis and lower extremity weakness than the control group (P<0.05). The observation group enjoyed significantly better quality of life than the control group did one and three months after surgery (P<0.05).
Conclusion: Given sufficient funding, EVAR should be preferentially selected in the treatment of AAA complicated with hypertension due to minimal invasion, safety, stable postoperative vital signs and improved quality of life.

KEY WORDS: Endovascular aneurysm repair; Abdominal aortic aneurysm; Hypertension; artificial blood vessel replacement; Quality of life.

doi: http://dx.doi.org/10.12669/pjms.321.7966

How to cite this:
Peng XT, Yuan QD, Cui MZ, Fang HC. Clinical outcomes of endovascular aneurysm repair of abdominal aortic aneurysm complicated with hypertension: A 5-year experience. Pak J Med Sci. 2016;32(1):13-17. doi: http://dx.doi.org/10.12669/pjms.321.7966

INTRODUCTION
Aortic aneurysm, although infrequent in clinical practice [e.g. incidence of primary abdominal aortic aneurysm (AAA): only 2%], leads to poor prognosis and high mortality rate.¹ In general, aneurysm locally dilates normal artery by over 50% in the diameter. Particularly, the abdominal aorta sized >3 cm is referred to as AAA.²⁻³ On the other hand, hypertension is the main risk factor for AAA, especially in the patients aged about 65 years old. AAA complicated with hypertension, when ruptured, gives rise to extremely high mortality rate (i.e. over 90%), thus requiring surgical treatment based on proper indications.⁴
Since the 1990s, patients have been treated with minimally invasive surgeries as the standard method which, however, results in traumas, severe postoperative cardiac and pulmonary complications or slow recovery. With the development of surgical techniques, anesthetic monitoring and perioperative care, endovascular aneurysm repair (EVAR) has been widely performed in clinical practice and it excels open surgeries in lowering the mortality and morbidity rates. It is now well-accepted that traditional surgery is suitable for the hypertension patients with infrarenal AAA. However, EVAR is restricted by anatomical characteristics and plaques of the aneurysm neck, angulation of the iliac artery, degree of calcification, and blood supply of important arterial branches. Hence, we herein analyzed the therapeutic effects of EVAR on AAA complicated with hypertension.

**METHODS**

**Subjects:** Fifty-two patients with AAA complicated with hypertension treated in our hospital from February 2008 to January 2013 were selected. This study was approved by the ethics committee of He'nan Provincial People's Third Hospital. Written consent has been obtained from all patients.

**Inclusion criteria:** Patients conforming to the diagnostic standards for AAA complicated with hypertension; patients with touchable and painless pulsating masses in the abdomen; patients with infrarenal AAA sized lower than 5 cm and requiring treatment.

**Exclusion criteria:** Patients complicated with severe hepatic and renal diseases; patients complicated with mental diseases; pregnant women; patients younger than 20 years old.

The patients were divided into an observation group (34 cases) and a control group (18 cases). The two groups had similar gender ratio, age, aneurysm size, number of patients who smoked or drank, systolic blood pressure and diastolic blood pressure (P>0.05) (Table-I).

**Surgical Methods:** Control group: The patients were treated by incision of AAA and artificial blood vessel replacement. Under general anesthesia, soft tissues were separated layer-by-layer after laparotomy, and the posterior peritoneum was cut open to expose AAA. Then the proximal- and distant-end aneurysm necks were blocked, and the aneurysm anterior wall was cut open to ligate lumbar artery and inferior mesenteric artery openings. Afterwards, appropriate artificial blood vessels were transplanted, and blood flow was recovered after inosculation. In the case these artificial blood vessels were wrapped by AAA, the abdominal incision was closed.

**Observation group:** The observation group was treated by EVAR. Under local anesthesia, the patients received EVAR in an operating room equipped with angiography devices. Approximately 5 cm long oblique incisions were made in bilateral inguinal regions to expose bilateral femoral arteries. Angiography for the abdominal aorta was conducted with the Seldinger technique to determine whether EVAR should be performed. Subsequently, a proper covered stent was selected and located at an appropriate position of the abdominal aorta under fluoroscopy. Thereafter the covered stent was released to make the anchor region adhere tightly to the wall, during which the blood flow outcomes were observed by angiography. Finally, the incisions were repaired.

**Observation Indices:** Perioperative observation: The surgical time, intraoperative blood loss and blood transfusion and total hospitalization expense of the two groups were observed. Criteria for successful EVAR: AAA was isolated without ruptures, and blood flowed smoothly inside the covered stent. Criteria for successful incision of AAA and artificial blood vessel replacement: Bloods flowed smoothly inside both the abdominal aorta and artificial blood vessels, without the latters infected.

**Complications:** Complications such as pulmonary infection, surgical site infection, lower-extremity

| Index                  | Observation group (n=34) | Control group (n=18) | \( \chi^2 \) or \( t \) | \( P \) |
|------------------------|-------------------------|----------------------|--------------------------|-------|
| Gender (male/female)   | 32/28                   | 31/29                | 0.064                    | >0.05 |
| Age (years old)        | 63.23±2.89              | 63.19±3.19           | 0.078                    | >0.05 |
| Aneurysm size (cm)     | 5.56±1.09               | 5.58±1.11            | 0.034                    | >0.05 |
| Smoking patients        | 28 (46.7%)              | 29 (48.3%)           | 0.043                    | >0.05 |
| Drinking patients       | 21 (35.0%)              | 20 (33.3%)           | 0.067                    | >0.05 |
| Systolic pressure (mmHg)| 159.33±11.98            | 160.09±12.78         | 0.119                    | >0.05 |
| Diastolic pressure (mmHg)| 97.19±9.23             | 97.56±8.91           | 0.098                    | >0.05 |
deep venous thrombosis and lower extremity weakness were observed in the postoperative 1st month.

Quality of life: The quality of life was investigated by SF-36 scale in the postoperative 1st and 3rd months, and a higher total score means better quality of life.

Statistical Analysis: All data were analyzed by SPSS 15.0. The categorical data were expressed as (x±s), and inter-group comparisons were performed by independent samples t-test. The numerical data were expressed as case numbers or composition ratios and compared by Chi-square test. P<0.05 was considered statistically significant.

RESULTS

Perioperative Indices: Compared with the control group, the observation group had significantly less surgical time, intraoperative blood loss and blood transfusion, as well as significantly higher total hospitalization expense (P<0.05) (Table-II).

Postoperative Complications: During the one-month follow-up, the observation group was significantly less prone to pulmonary infection, surgical site infection, lower-extremity deep venous thrombosis and lower extremity weakness than the control group (P<0.05) (Table-III).

Quality of Life: The observation group enjoyed significantly better quality of life than the control group one and three months after surgery (P<0.05) (Table-IV).

Case Analysis: CT images for the patients who received EVAR and traditional surgery are shown in Fig.1 and 2 respectively.

DISCUSSION

AAA complicated with hypertension, which is a severe aortic incident threatening human life, should be treated as early as possible to prevent rupture of the bulge. Despite improved surgical and
which has better compliance at the distal end than
prevent its displacement upon the impact of high-
lower blood pressure before releasing the stent to
aorta.11
maintaining smooth blood flow in the abdominal
flowed smoothly inside the covered stent, thus
blood flow inside vascular lumen, whereas blood
necks. As a result, the wall of AAA is isolated from
to cover the proximal- and distal-end aneurysm
abdominal aorta through the femoral artery, aiming
to lead an appropriate covered stent into the
EVAR is performed under real-time monitoring
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of stent diameter and length.14 It is important to
target aortic lesions, and to provide reference for
resonance angiography should be performed to
evaluate the postoperative psychological and physical health states, thus having been widely applied to assess the
health status of target patients.16,17 The observation
group showed significantly better quality of life than the control group did one and three months after surgery (P<0.05).
In summary, with sufficient funding, EVAR
can effectively treat AAA complicated with hypertension minimally invasively, giving rise to stable postoperative vital signs and improving the
quality of life.

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| Index                  | Observation group (n=34) | Control group (n=18) | t     | P   |
|------------------------|--------------------------|----------------------|-------|-----|
| Postoperative 1st month | 80.98±3.71               | 67.82±4.11           | 12.081| <0.05|
| Postoperative 3rd month | 88.89±4.21               | 73.29±4.98           | 13.992| <0.05|

During one month of follow-up, the observation
group suffered from significantly less complications such as pulmonary infection, surgical site infection, lower-extremity deep venous thrombosis and lower extremity weakness than the control group did (P<0.05). Probably, the observation group was not endangered by complications owing to minor traumas and short hospitalization stay. Notably, the surgical time, especially that for artery occlusion, should be minimized to decrease the risks of infection. Aortic CT angiography or magnetic resonance angiography should be performed to target aortic lesions, and to provide reference for the design of treatment protocols and the selection of stent diameter and length.14 It is important to lower blood pressure before releasing the stent to prevent its displacement upon the impact of high-speed blood flow. When released, a covered stent, which has better compliance at the distal end than that at the proximal end as well as larger distal-end diameter than proximal-end one, is highly recommended.15

SF-36 scale, also known as short-form health survey, is designed to investigate the quality of life and to evaluate the treatment outcomes by analyzing the postoperative psychological and physical health states, thus having been widely applied to assess the quality of life.18

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Authors’ Contribution:

XTP and QDY: Study and concept designs, critical revision of the manuscript;

MZC and HCF: Data collection, analysis and summarization, drafting of the manuscript.