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Abstract

[Purpose] To investigate acute blood pressure change during aortic angiography in aortic dissection endovascular repair, and analyse the potential risk of this incident.

[Method] 24 patients with aortic dissection underwent endovascular repair in department of vascular surgery of Changhai hospital between May 2016 and July 2016 were enrolled in this research. Patients were divided into two groups: patients underwent general anesthesia and patients underwent lumbar anesthesia. Blood pressure was monitored by intro-artery catheter. Blood pressure readings were recorded every 10 seconds during the procedure of angiography. Outcome of these patients were observed in hospital.

[Result] All patients received endovascular aortic repair, with 19 underwent lumbar anesthesia and 5 underwent general anesthesia. Patients underwent lumbar anesthesia presented temporary blood pressure decrease with average of -11.2 ± 13.4 mmHg, while patients underwent general anesthesia presented temporary blood pressure elevation with average of 4.2 ± 6.3 mmHg. The Maximum time interval were 26.7 ± 12.7 s vs 25.8 ± 15.8 s, and difference in blood pressure between pre- and post-angiography were 1.53 ± 4.4 mmHg vs. 4.6 ± 3.4 mmHg, both without significance ($P > 0.05$).

[Conclusion] Angiography is an effective factor influencing blood pressure during TEVAR, it's a potential "trigger" of intra-operative cardiovascular events. Blood pressure should be kept on proper level to avoid cardiovascular events induced by blood pressure variability with angiography. Angiography with General anesthesia has less influence on blood pressure than with lumbar anesthesia.

Keyword: aortic angiography; blood pressure variability; endovascular repair

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Blood pressure is one of the most important risk factor for patients with aortic dissection, especially in process of endovascular therapy. In procedural of endovascular repair, high blood pressure may induce tearing of dissection, or encephalorrhagia, while low blood pressure may induce perfusion-insufficiency of important organs, resulting in stroke, cardiac infarction or paraplegia. In some key steps of intervention, blood pressure should be regulated. Blood pressure should be temporarily decreased when stentgraft was

released, in order to reduced the possibility of migration Blood pressure should be elevated when long thoracic aorta was covered by stentgraft, to prevent paraplegia. In some papers, researchers also found intra operative blood pressure variability may resulting adverse events¹.

It is important to maintain proper blood pressure during operation therapy. However, we found that in some cases blood pressure changes roughly. We found aortic angiography might induce acute blood pressure variability, And the different type of blood pressure change may related with different anesthesia.

An investigation was therefore performed, in which blood pressure was measured during angiography in endovascular repair of aortic dissection. Potential risk of blood pressure change was discussed.

1. Method

1.1 Patient selection

Patients underwent endovascular aortic repair from March 2011 to July 2011 in Changhai hospital were enrolled in this study. All patients received intra-artery blood pressure monitoring and aortic-angiography. Patients were categorized into 2 groups: Group A: patients with lumbar anesthesia; Group B patients with general anesthesia. Patients in both groups received endovascular repair, with at least one stent-graft implantment. The exclusion criteria were: patients without intra-artery blood pressure monitoring; patients with local anesthesia.

1.2 Blood pressure recording

Blood pressure values were captured via intro-artery catheter, and monitored by Philip 5200. The blood pressure was measured with 10 second intervals simultaneously. Injection of contrast was signal of recording beginning. Recording continued after injection, until blood pressure values became stable.

Aortic angiography parameter: omnipaque: 40 ml, pressure 800: kpa, velocity: 20ml/s. Every patient underwent aortic angiography twice: pre- stentgraft placement and post stentgraft placement. Three parameters were defined to evaluate the blood pressure variability: (1) Maximum Variation (MV): The Maximum value of blood pressure during the process minus blood pressure value at the beginning. (2) Peak-time Interval (PTI): time interval between the beginning and the moment of maximum(or minimum) value. (3) Pre- and Post- angiography Variation (PPV): The stable value of blood pressure post-angiography minus blood pressure value at the beginning.

1.3 Statistical Analysis

Data records were transferred into computer. PASW Statistics 18.0 were used to analyze the data. Shapiro-Wilk test was used to indentify normal distribution. Measurement data in normal distribution were expressed as mean±SD. Non-normal distribution data was described as median. T-test was used in normal distribution data, and nonparametric test was used in other data. $P \leq 0.05$ was regarded significant.

2. Result

2.1 Patient Population

From May. 2016 to July. 2016 , 42 patients received endovascular repair in Vascular surgery department of

Changhai hospital. Exclude patients without intra-artery blood pressure monitoring and with local anesthesia, 24 patients entered the study, 19 (79.2%) male and 5 (20.8%) female. The average age was 65.4±15.1. 5 patients were with diabetes and 20 were with hypertension. All patients received endovascular repair, 19 with lumbar anesthesia and 5 with general anesthesia. Technical success of endovascular therapy was 100%.

2.2 Blood pressure variability during angiography

Blood pressure changed during angiography in patients with lumbar anesthesia presented as Fig 1. Blood pressure elevated in 5 patients while decreased in 18 patients. There was 1 patients presented no significant change of blood pressure. Fig. 2 shows the number of patients with different type.

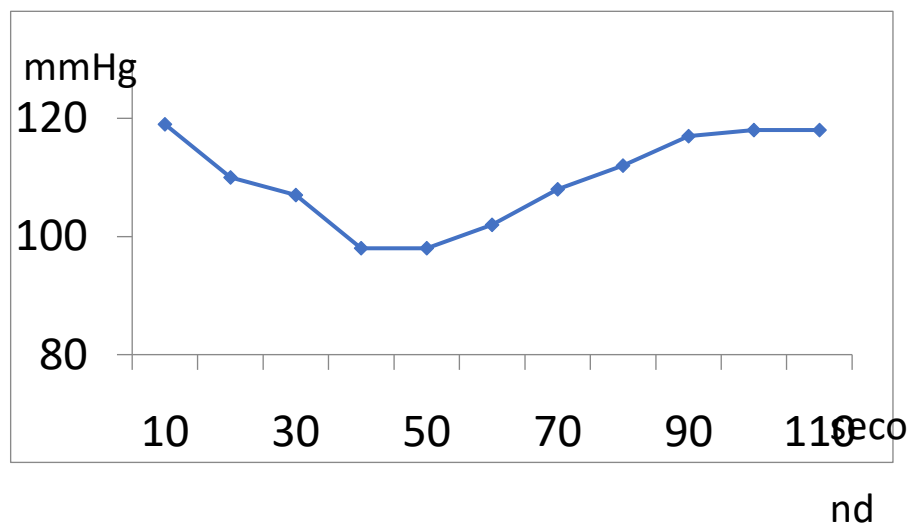


Fig. 1 Blood pressure decreased temporarily after angiography in patients with lumbar anesthesia

2.3 General anesthesia versus lumbar anesthesia

There were 5 patients in general anesthesia group, and 19 patients in lumbar anesthesia group. The pre-operation blood pressure difference between two groups was with no significant (P>0.05). The two group presented different type of blood pressure changes. Blood pressure of Group A mainly decreased while Group B mainly elevated. The MV of patients in Group A was -12 mmHg, which is significantly different from MV in Group B with 5 mmHg (p<0.05). PPI of group A was 1 mmHg, while group B was 6 mmHg, difference was no significant. PTI of group A was 26.7±12.71 seconds, while group B was 25.8±15.78 seconds, with no significant difference. Table 1 shows the contrast of the two groups. Fig. 3 shows the curve of mean blood pressure in different groups.

Table 1 Contrast of blood pressure variability between two groups

Group	MV (mmHg) [M(Q1, Q3)]	PPV (mmHg) [M(Q1,Q3)]	PTI (second) ($\bar{X} \pm SD$)
Group A	-12 (-16,-5)	1 (-1,3)	26.7±12.71

Group B	5 (0,8)	6 (2,7)	25.8±15.78
statistical magnitude	Z= 2.35	Z= 1.61	F=0.02
P value	0.0189*	0.1082	0.8961

PS: *P<0.05 was regarded with significant difference.

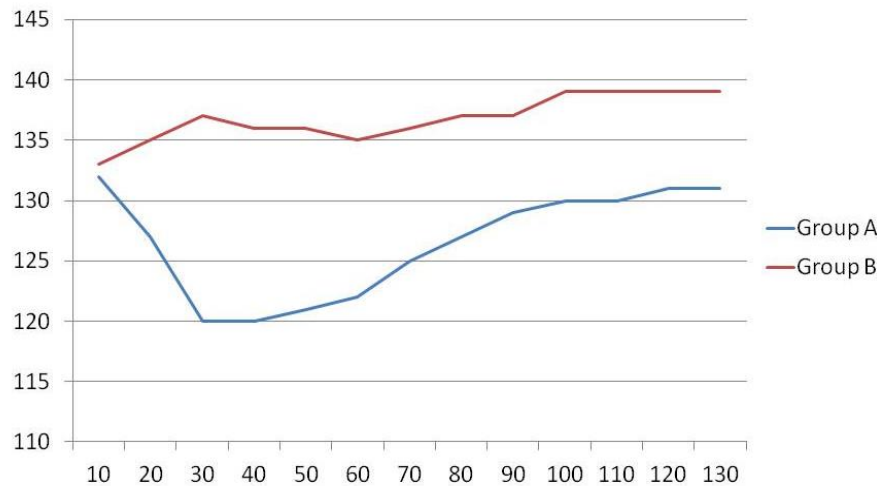


Fig. 3 Mean curve of blood pressure change during angiography in two groups

2.4 In hospital outcome

No critical adverse event was observed during hospital time in both two groups.

3. Discussion

Blood pressure change during aortic angiography were analyzed. The result reveals that angiography definitely influence blood pressure change. Blood pressure change showed opposite sign between lumbar anesthesia and general anesthesia. Blood pressure decreased with lumbar anesthesia and elevated with general anesthesia. However, after about 120 seconds, the two kinds of blood pressure became the same, which indicated that it’s just temporary change. It could not last long. Another same point was that the time interval to peak of blood pressure change. This indicate that effect of contrast on patients was the same, the only different thing is the anesthesia.

The reason blood pressure decreased during angiography for lumbar anesthesia may be: 1. The high-velocity fluid injected by the squirt stimulates the aortic baroreceptor, induces reflective blood pressure decrease. 2. Contrast itself may induce blood pressure decrease. The reason blood pressure elevated during angiography for general anesthesia may be: 1. Baroreceptor be blocked by general anesthesia, so the high-velocity fluid can not induce reflective blood pressure decrease. 2. The high-velocity fluid may inject into left subclavian artery or innominate artery, where the intra-artery catheter placed, and induce the measurement of blood pressure elevated.

Blood pressure variability impacts the outcome of vascular diseases. Rothwell et²⁻⁵ found that the visit-to-

visit blood pressure variability was an independent risk factor for stroke. Pringle et⁶ revealed BPV during the night time was a risk factor for cardiovascular events. In the research of Dawson et⁷, diastolic BPV predicted poor outcome of patients with previous stroke.

Previous reports showed that blood pressure variability during operation also relate with outcome of therapy. Aronson et^{8, 9} found that BPV during coronary bypass operation related with 30 day mortality post operation. Lukasz et¹ analyzed intra-operative BPV of 200 coronary bypass patients, found that female, smoker, patients less than 60 years old, patients without diabetes, patients without hypertension were likely to have higher BPV during operation.

As the importance of BPV, an interesting investigation was performed to identify the factors that can be responsible for BPV in our life⁵ over the short and medium term. The main factors include: anger/conflict, sexual intercourse, major physical exertion, pain, waking from sleep mid-morning surge, etc. However, factors responsible for intra-operative BPV has not been studied. We found during EVAR, blood pressure change temporarily while angiography, but differently in different patients. The outcome of this study reveals the effect of anesthesia on blood pressure variability during angiography. This study may be more precise than previous daily-life study, because: 1. we controlled the environment and diminished other factors that may influence blood pressure. 2. Intraartery blood pressure monitoring is more precise than blood pressure measurement in daily-life. Rothwell et al adopted a minimum of 5 mmHg variation while we adopted 3 mmHg, which is more precise.

4. Study Limitation

This study contained only 24 patients, which is a limited number. And this it was performed in a single center.

5. Conclusions

This research reveals that angiography is a factor influencing blood pressure during EVAR. It may be a “trigger” of intra-operative cardiovascular events. Make sure blood pressure was in normal level before angiography, especially in patients with refractory hypertension or shock, or angiography induced blood pressure variability may trigger serious cardiovascular event. Blood pressure varies less in general anesthesia than in lumbar anesthesia, reveals that general anesthesia may be safer than lumbar anesthesia.

6. Acknowledgement

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