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Clinical study on the relationship between blood pressure and brachial artery dorsalis pedis artery blood pressure intra aortic blood pressure

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ABSTRACT

Objective : The lower limb blood pressure measuring method.**Methods** : The hypertension group and non hypertension group a total of 107 patients were taken with cuff around the lower leg monitoring of blood pressure of dorsalis pedis artery, and the blood pressure, blood pressure of brachial artery and intra aortic comparative study.

Results : Significantly positive correlation of two groups of dorsalis pedis artery blood pressure and brachial artery blood pressure ($P<0.001$), blood pressure and aortic blood pressure between two groups in the limbs, in addition to the hypertension group ankle arterial diastolic blood pressure were significantly correlated ($P<0.05$). The ankle systolic blood pressure and diastolic blood pressure was higher than 10 and 5mmHg of the brachial artery; brachial systolic blood pressure below the aortic internal compression pressure 5mm Hg, diastolic blood pressure higher than the intra aortic diastolic pressure 5 ~ 6mmHg; the ankle systolic blood pressure higher than the aortic internal compression pressure 6mm Hg, diastolic blood pressure higher than the intra aortic diastolic pressure 10mmHg.**Conclusion** : Method for measuring the dorsalis pedis artery blood pressure is credible, but the hypertension group ankle artery diastolic pressure is poorly correlated with intra aortic diastolic.

KEYWORDS

Blood pressure determination; Method; Ankle.

INTRODUCTION

In clinical work, first diagnosed hypertension patients should be routinely measured blood pressure in limbs; upper extremity trauma, burn, Takayasu arteritis, thromboangiitis obliterans, congenital aortic coarctation deformity of lower limb blood pressure, measurement is essential. The lower limb blood pressure measurement method is the traditional patients were supine or prone position, with cuff around the lower thigh, lower margin from the popliteal fossa for 3 ~ 5cm, the stethoscope on the popliteal fossa popliteal artery blood pressure measurement. However, in clinical practice, this method has many disadvantages, foreign had about the cuff around the distal leg measurement of posterior tibial artery and dorsal pedal artery blood pressure in that report, can not be measured in upper limbs and thigh under this method can be used[1-3]. Convenient lower limb blood pressure measurement method credible for exploring, taken with cuff around the lower leg, method for monitoring of blood pressure of dorsalis pedis artery, and the blood pressure and brachial artery blood pressure of aorta in comparative study.

MATERIALS AND METHODS

Clinical data

Health workers in the hospital or hospital patients, a total of 251 cases. There were 120 males, 131 females, aged 19 ~ 81 years, mean age (41.9±15.9) years old. All objects on the same side of the upper limb measurements (elbow midline 9cm) and lower limb (11cm medial malleolus) limb circumference, blood pressure is measured at the midpoint of the equivalent width of the cuff. Objective to understand the use of conventional cuff is feasibility of dorsalis pedis artery blood pressure measurement. Selection of hospitalization for coronary angiography in patients with a total of 115 cases, including 8 cases of failed to touch the dorsal artery of foot and not selected, the remaining 107 cases selected. There were 88 males, 19 females, mean age (52.1±9.4) years old. According to the non hypertension 107 patients were divided into two groups: hypertension group with 31 patients, mean age (53.5±9.3) years old; non hypertension group with 76 patients, mean age (51.5±9.4) years old. All the cases were excluded from the limb or celiac artery stenosis, Takayasu arteritis, thromboangiitis obliterans and other vascular diseases.

Measurement methods

Measurement of blood pressure in the duct interior, with the patient in the supine position, the aortic pressure by percutaneous retrograde aortic catheter placed in the aortic root, pressure transducer catheter connected to the tail of conductive physiological recorder, recording the pressure curve in aorta, and read out the value of blood pressure.

Time point of the blood pressure measurement

Brachial artery blood pressure measurement is with cuff around the mid upper arm, the lower edge of the cuff from the cubital fossa of 2 ~ 3cm, the stethoscope on the elbow Waterloo brachial artery pulse. Ankle artery blood pressure measurement is the cuff around the lower part of the leg, the lower edge of the cuff from the medial margin of 5cm, the stethoscope on the dorsalis pedis artery pulse. Limb blood pressure were using adult upper limb pressure cuff (rubber bag length 24cm, width 12cm), determine the systolic and diastolic blood pressure as the international Krotkoff staging method; the blood pressure values are in average 3 times calculation. Parts of the blood pressure measurement are completed in 30 minutes.

The experimental data were expressed asmean±standard deviation (mean±SD), and analyzed using analysis of variance, paired t-test and linear regression by the SPSS13.0 software package, P <0.05 was statistically significant for difference or correlation coefficient.

RESULTS

51 cases of upper arm and leg wrapped around the midpoint circumference cuff comparison (TABLE1): the t test results, two men and women showed no significant difference (P>0.05), suggesting that both men and women leg week and upper arm close to, so use the dorsalis pedis artery blood pressure cuff measurement routine is feasible.

TABLE 1 : The same side arm and leg position and pressure diameter comparison (cm,mean±SD)

Gender	Groups	Upper arm circumference mean	Calf circumference mean
Female	131	24.28±3.06	24.47±2.69*
Male	120	25.56±2.62	24.07±2.18*

Between the 2 groups, $^{*}P>0.05$

Comparison of ankle artery blood pressure and aortic blood pressure: there was a significant correlation between blood pressure and aortic blood pressure in non hypertension group (P<0.05). Paired t test results showed that the average dorsalis pedis artery systolic blood pressure higher than the aortic internal compression pressure of 6mm Hg (P<0.01), diastolic pressure is higher than the intra aortic diastolic pressure of 10mm Hg (P<0.001). Hypertension group dorsalis pedis

artery systolic pressure and diastolic aortic adduction was significantly correlated (P<0.05), hypertension group ankle foot dorsal artery diastolic blood pressure and aortic diastolic pressure correlation did not reach statistical significance (P >0.1) (TABLE 2).

TABLE 2 : Correlation test of dorsalis pedis artery blood pressure and aortic blood pressure (mmHg,mean±SD)

Groups		The left dorsalis pedis artery	The right ankle dorsal artery of foot	Aortic
Hypertension (n=31)	SBP	149.68±23.79**	149.81±22.95**	149.56±22.49
	DBP	98.97±12.98#	97.98±11.98**	84.59±15.34
Nonhypertension (n=76)	SBP	138.15±19.03**	137.01±17.03**	132.15±14.03
	DBP	88.13±10.98*	88.92±11.51**	77.07±9.04

Between the 2 groups, *P<0.05,P<0.01 was considered significant differences**

Correlation between blood pressure and brachial artery dorsalis pedis artery, two groups were significant (P < 0.001) (TABLE 3),Paired t test results show that the non hypertension group dorsalis pedis artery systolic and diastolic blood pressure were higher than brachial artery 5mm 10 and Hg (P < 0.01).

TABLE 3 : Correlation test of dorsalis pedis artery blood pressure and brachial artery blood pressure (mmHg,mean±SD)

Groups		The left dorsalis pedis artery	The right ankle dorsal artery of foot	The left brachial artery	The righe brachial artery
Hypertension (n=31)	SBP	157.02±24.02**	154.01±22.86**	150.92±20.04	149.83±17.97
	DBP	100.01±12.89**	98.88±13.03**	96.04±10.98	94.96±12.03
Nonhypertension (n=76)	SBP	138.03±17.97**	135.93±17.92**	128.01±13.98	126.03±14.23
	DBP	88.03±10.98**	88.12±11.57**	82.88±9.03	82.08±8.94

Between the 2 groups, **P<0.01 was considered significant differences

Correlation test brachial artery blood pressure and aortic blood pressure, the two groups were significantly (P<0.05) (TABLE 4),Paired t test results show that the non hypertension group brachial systolic blood pressure below the aortic systolic 5mm Hg,Brachial artery diastolic pressure is higher than the intra aortic diastolic pressure 5 ~ 6mm Hg (P<0.001).

TABLE 4 : Correlation test brachial artery blood pressure and aortic blood pressure (mmHg,mean±SD)

Groups		The left brachial artery	The righe brachial artery	Aortic
Hypertension (n=31)	SBP	150.92±20.06**	149.83±18.32**	151.89±21.89
	DBP	95.83±11.31*	95.26±11.27*	85.48±14.37
Nonhypertension (n=76)	SBP	128.14±13.28**	125.83±14.10**	130.45±13.93
	DBP	82.78±8.94*	89.02±9.04*	77.06±8.58

Between the 2 groups, *P<0.05,P<0.01 was considered significant differences**

DISCUSSION

Arterial blood pressure normal value 20~40mmHg higher than the pressure in the arm,If it is equal to or lower than the upper limb blood pressure, indicating the corresponding part of artery stenosis or occlusion,In coarctation of the aorta, thoracic and abdominal aorta arteritis:, arteriosclerosis obliterans, iliac artery or femoral artery embolism[4]. The artery catheterization was directly measured on the lower limb blood pressure did not differ[5]. How to eliminate the pressure difference between upper and lower limbs, some reports over the years, but there is no reliable method. A liquid pressure and liquid depth, density was proportional to the principle, in the popliteal artery blood pressure is measured, the lower extremity pad high 30cm, the value is not elevation decreased 20~30mmHg. This method is inconvenient and not accurate enough for hypertension or insufficient blood volume in patients[6]. Taking into account the hypertensive effects on vascular elasticity, the cases were divided into hypertension group and non hypertension group. The results show that, the blood pressure and

brachial ankle artery blood pressure and aortic blood pressure in non hypertension group had significant correlation. Dorsalis pedis artery hypertension group diastolic blood pressure and aortic diastolic pressure was not statistically significant,It indicated that the long-term hypertension induced hardening of the arteries, the pipe wall elasticity, diastolic pressure has great influence on. The experimental data in the statistical analysis on the linear regression correlation analysis was carried out, using paired t test, aims to find gaps and regularity of blood pressure and aortic endovascular limbs blood pressure, brachial artery and dorsalis pedis artery blood pressure. Brachial systolic blood pressure below the aortic internal compression pressure 5mm Hg, diastolic blood pressure higher than the intra aortic diastolic pressure 5 ~ 6mm Hg; dorsalis pedis artery systolic blood pressure higher than the aortic internal compression pressure 6mm Hg, diastolic blood pressure higher than the intra aortic diastolic pressure 10mm Hg. Dorsalis pedis artery systolic and diastolic blood pressure were higher than brachial artery blood pressure of high 10 and 5mm Hg. These results showed that blood pressure of dorsalis pedis artery is more close to the upper limb blood pressure value, the error is smaller. Cuff width and limb circumference ratio are the key factors influencing the physical measurement of blood pressure, the pressure in the same blood vessels, the indirect method measured blood pressure and limb circumference were positively correlated, but negatively correlated with the cuff rubber sac width, length. For the same group of patients, the cuff air bag narrow and short, it needs to use the inflation pressure can be blocked artery is higher, the results measured blood pressure is high; conversely, the cuff air bag with wide and long, the blood pressure is lower[7]. Clinical on the routine use of the cuff air bag is 24cm long, 12cm wide, applies only to the upper and lower pressure, thigh week is upper limb is large, with a cuff pressure, is bound to cause the error. Although the measurement of lower limb blood pressure cuff should require textbooks than 2cm wide measurement of upper limb[8]. But the general hospital is not equipped with the conventional cuff. Through the observation of 251 cases, confirmed the distal leg circumference and arm circumference is close to,Theoretically the conventional cuff is wrapped around the leg method in determination of arterial blood pressure is reasonable. In fact, this group of 115 subjects, 107 cases of ankle arterial blood pressure can be measured, accounting for 93% of all cases, shows that this method is feasible in clinical. In fact, this group of 115 subjects, 107 cases of ankle arterial blood pressure can be measured, accounting for 93% of all cases, shows that this method is feasible in clinical.

The results show that: the method for measuring the dorsalis pedis artery blood pressure is credible, but the hypertension group ankle artery diastolic pressure is poorly correlated with intra aortic diastolic.

Blood pressure monitoring includes non-invasive and invasive blood pressure monitoring, in which noninvasive brachial artery blood pressure monitoring, as the blood pressure close to the aortic blood pressure, is still the most common and important clinical method, is important clinical indicators and monitoring means for assessment of cardiovascular function and circulatory function in resuscitation. Invasive blood pressure monitoring can provide accurate, reliable and continuous arterial blood pressure data, but the technical requirements of its equipment and operation, invasive complications and "implementation period" limits its clinical application, especially in the early periods of resuscitation. Previous studies have shown that, for the same intravascular pressure, the blood pressure values measured by the indirect method were positively correlated to the extremity perimeters. Monitoring perimeter of the popliteal fossa is much larger than the upper extremity, therefore, popliteal artery blood pressure measured with the conventional elbow arterial blood pressure measurement cuff is often significantly higher[5], the monitor cuff requirements and inconvenient limit its application, which is only commonly used for auxiliary diagnosis in diseases in coarctation of the aorta, Takayasu arteritis, or arteriosclerosis obliterans[6], but the following cases require clinical monitoring of the lower extremity invasive or non-invasive blood pressure[7-8]: (1) The first aid when double upper extremity trauma or burns, especially the resuscitation with systemic trauma; (2) The intraoperative and postoperative guardianship of both upper extremities surgery at the same time; (3) congenital coarctation of the aorta deformities which need to monitor blood pressure to guide treatment of trauma, shock, or other surgical diseases.

In the case of shock, resuscitation and first aid, arterial blood pressure is one of the most commonly used indicator of clinical human data collection process, the accuracy of measurement is directly related to the condition analysis, judgment and processing, so no matter what measurement method is used, accuracy and dynamic change is extremely important. This study shows that, in mild and moderate shock and resuscitation process, with vasoactive drugs, ankle dorsalis pedis arterial blood pressure and brachial artery blood pressure values are close, consistent with the change. When the blood pressure returned to normal after basic resuscitation success, the two parts of blood pressure is still highly significant, prompt that, to common clinical hypovolemic shock, during first aid resuscitation, monitoring of the ankle dorsalis pedis artery blood pressure also can be a timely, realistic assessment of the body's circulatory function. However, brachial artery blood pressure monitoring cannot be implemented in a severe trauma, shock rescue process, the implementation of the ankle dorsalis pedis artery noninvasive blood pressure monitoring in a short period, at the same time with a timely implementation of the lower extremity invasive arterial monitoring is necessary.

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