A novel role of chitosan in reducing vascular access bleeding complications after transradial angiography

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Abstract: **Objective**: To investigate the safety and efficacy of chitosan (Anscare,Daxon) in reducing vascular access complications compared to a kind of radial compression device(TR-BAND,Terumo) . **Method**: We studied 128 patients who had undergone transradial angiography in our center from December 2009 to April 2010. Among them,64 patients were randomly treated with radial compression device (TR-BAND,Terumo) when the procedure was over (CD group) . The other 64 patients were dealt with chitosan (CS group) . The compression time,the major and minor access site bleeding complications and the errhysis were observed. **Results**: There were no statistical differences in the baseline clinical characteristics of the patients between two groups. The compression time in CS group was significantly shorter than that of CD group ($P<0.001$) . There were 12 patients suffering from minor access site bleeding while only 3 patients experienced these minor complications in CS group(19% vs 4% ,$P<0.05$) . At the same time 20 patients had errhysis in CD group and 4 patients in CS group (31% vs 6% ,$P<0.001$) . **Conclusion**: Chitosan,compared to radial compression device (TR-BAND,Terumo) ,can not only shorten the compression time,but also significantly reduce the rate of minor access site bleeding and puncture-site errhyis.

Introduction

Transradial access has been showed to be an attractive approach for angiography or percutaneous coronary interventions (PCI) [1-4]. With the appearance of transradial access,new compression methods have also been developed. Improved techniques with active clotting surfaces and components have been recently reported to accelerate hemostasis in moderate to severe bleeding[5-7]. Chitosan is a biodegradable,nontoxic,complex carbohydrate derivative of chitin,a naturally occurring substance. In its acid salt form,chitosan demonstrates mucoadhesive activity,which makes it an ideal candidate for consideration as a hemostatic agent[8]. The purpose of our study was to investigate the safety and efficacy of chitosan (Anscare,Daxon) in reducing vascular access complications compared to (TR-BAND,Terumo) radial compression device.

Method

Study population

This study is a single-center comparative clinical trial. From December 2009 to April 2010,128 patients who had undergone TRA (transradial angiography) in our center were randomly divided into two groups. Among them,64 patients were treated with radial compression device (TR-BAND,Terumo) (CD group) while the rest 64 patients with Chitosan (CS group) . Exclusion criteria for the radial approach included: 1) failure to puncture the radial artery in one attempt; 2) inaccessible radial arteries in cases where there were hypoplastic radial arteries or a radioulnar loop. 3) Patients receiving interventional therapy. All of the enrolled patients gave informed consent for this study.

TRA procedure

All patients received aspirin (100 mg) and clopidogrel (75 mg) at least 3 days prior to the procedure. Patient's arm was slightly abducted and the wrist hyperextended over a gauze roll. After skin anesthesia o-

ver the radial area by local infiltration of 1% lidocaine, the artery was punctured with a 21-gauge needle (Cordis) , and 0. 53 mm straight tip guidewire (Cordis) was carefully advanced through the needle. Once the puncture needle was removed, a 5Fr sheath (Cordis) was inserted into the artery. Thereafter, 10cc of a nitroglycerin cocktail (mixture of normal saline, 100 μg nitroglycerin and 2cc 1% lidocaine) was injected into the sheath to prevent arterial spasm and a bolus of heparin (5 000 IU) was administered through the sheath.

Radial artery access site hemostasis

In CS group , hemostasis was obtained as follows: after applying pressure over the proximal area above the puncture site, the sheath was removed. Chitosan pad was placed over the puncture site while still maintaining pressure over the same proximal area. Then we allowed a small amount of blood to come into contact with the chitosan pad, and again maintained constant pressure for about 10 seconds. Finally, an elastic bandage was placed around the chitosan pad in order to have a constant pressure. In CD group the radial compression device was applied in three steps: Firstly it was placed above the puncture site. Thereafter the air sac was inflated with 8ml of air in order to have moderate pressure over the sheath. Finally sheath was removed and the air sac was again inflated with an additional 8 ml of air in order to have a constant pressure.

Monitoring of hemostasis

The time of compression was defined as the time interval from the time of sheath removal to the time compression device or elastic bandage was removed from the puncture site. In CD group, hemostasis was checked every 1 hour by gradually releasing the air from the air sac. If hemostasis was not achieved, the air sac would be inflated slightly more. When hemostasis was achieved, air sac was deflated to 8ml and observed for 5 minutes. Consequently the compression device was removed and sterile dressing applied to the wound. In CS group, hemostasis was checked every 1 hour by gradually setting the elastic bandage loose. Access site bleeding was defined as major if it was associated with hemoglobin loss of at least 13g/dl, administration of blood transfusions, or requiring vascular repair. Minor access site bleeding was defined as haemotoma formation not requiring specific therapy.

Statistics

Statistical analysis was performed using the spss13. 0 statistical program (SPSS Inc, Chicago. USA) . Continuous variables were expressed as mean ± standard deviation and compared with Student's t test. The differences between categorical variables were examined by chi-square test. $P < 0.05$ was considered statistically significant.

Results

The baseline clinical characteristics of the patients are summarized in Table 1. Mean age, sex, and risk factors were similar in both groups. There was no statistical difference in BMI (body mass index) , INR (international standard ratio) and platelet concentration between the two groups ($P > 0.1$) .

Tab. 1　Baseline clinical characteristics

	CD (n = 64)	CS (n = 64)	p-value
Age(years)	65.0 ± 10.5	66.6 ± 11.8	0.411
Male, n(%)	41(64)	35(55)	0.108
Hypertension n(%)	44(69)	42(66)	0.851
Diabetes n(%)	21(33)	21(33)	1
BMI (kg/m^2)	24.8 ± 3.1	24.8 ± 2.7	0.918
INR	0.99 ± 0.14	0.96 ± 0.10	0.106
Platelet concentration (10^9/L)	214 ± 72.4	195 ± 59.1	0.117

Procedural characteristics are shown in Table 2. There was no statistical difference in procedure time and systolic blood pressure ($P > 0.05$) .

Table 3 summarized the outcome of vascular ac-

cess site bleeding complications in the present study. The compression time in CS group was significantly shorter than that of CD group ($P<0.001$) . We noted that there were 12 patients who had minor access site bleeding in CD group and only 3 patients experienced these minor complications in CS group(19% vs 4% , $P<0.05$) . At the same time we also noted 20 patients had errhysis in CD group and 4 patients in CS group (31% vs 6% , $P<0.001$) .

Tab. 2 Procedural characteristics

	CD ($n=64$)	CS ($n=64$)	p-value
Procedure time(min)	25.1 ±17.7	28.7 ±22.7	0.314
Systolic blood Pressure(mmHg)	133.3 ±18.1	131.6 ±20.6	0.448

Tab. 3 Outcome of vascular access site bleeding complications

	CD ($n=64$)	CS ($n=64$)	p-value
Compression time(min)	354.5 ±44.0	241.9 ±10.5	<0.001
Minor access site bleeding(%)	12(19)	3(4)	0.025
Major access site bleeding (%)	0	0	
Errhysis(%)	20(31)	4(6)	<0.001

Discussion

The development of this technology allows a marked decrease in the diameter of balloons and stents cross profile, hence making TRI popular worldwide. However, although bleeding complications are rare, they do still exist and are generally classified as Major access site bleeding and Minor access site bleeding[4,9-12]. To further reduce the rate of vascular access bleeding complications, several artery access hemostatic devices have been developed[13-15]. The use of Chitosan, in helping to accelerate vascular hemostasis following transradial catheterization, has grown rapidly over the past several years. In this study, we found that chitosan could significantly reduce the rate of Minor access site bleeding compared to the TR Band, Terumo radial compression device. During our experience, we found that puncture-site errhysis, except for Minor access site bleeding, happened in many patients after TRA. Although it did not bring up any serious event, puncture-site errhysis did make patients uncomfortable and nervous. Our study showed that with help of chitosan, the rate of errhysis was reduced dramatically thus making patients more comfortable and peaceful.

Maintaining pressure for a prolonged period after sheath removal is not recommended because of the risk of early radial artery occlusion. This trial demonstrated that the compression time in CS group was significantly shorter than that of CD group hence suggesting a better outcome in patients' radial artery when this strategy is applied to it.

Conclusion

Chitosan can not only shorten the compression time, but also significantly reduce the rate of Minor access site bleeding and puncture-site errhyis compared to the TR Band, Terumo radial compression device.

Limitations

Limitations of this study include those inherent to a single-center study with a moderate sample. However, the two group patients shared similar baseline clinical characteristics which make our conclusion to be rather persuasive.

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