A Case of Accordion Phenomenon Accompanied by Severe Transmural Myocardial Ischemia

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SUMMARY

Percutaneous coronary intervention was performed in a severely tortuous right coronary artery (RCA). Immediately after straightening its tortuosity by using two guidewires, angiographic slow flow, ischemic electrocardiographic changes, and anginal pain developed. This is a rare case who had severe myocardial ischemia caused by the accordion phenomenon. (Jpn Heart J 2002; 43: 49-54)

Key words: Accordion effect, Buddy wire technique, Myocardial ischemia

TORTUOUSITY of coronary arteries is one of the major obstacles for percutaneous coronary intervention (PCI), because it means less accessibility to distal lesions. Straightening such tortuous coronary arteries using a stiff guidewire is usually a quite effective maneuver with which to improve the accessibility of various PCI devices to distal targets. However, such mechanical distortion of coronary geometry sometimes results in pseudo-stenosis or haziness of the straightened segment, which has been recognized as the “accordion phenomenon”. It is quite important to recognize such events because these angiographic abnormalities are basically benign and should be treated simply by withdrawing the guidewire and restoring coronary geometry. The following case is a typical example of “accordion phenomenon” which caused angiographic slow flow accompanied by ischemic electrocardiographic change and severe anginal pain.

CASE REPORT

A 53 year-old Japanese male was transferred to our hospital because of persistent chest pain. He was diagnosed with an acute posterior myocardial infarction based on clinical findings such as ST segment elevation in the posterior ECG leads and echocardiographic posterior-lateral wall motion abnormality. Emergent
coronary angiography (CAG) revealed total occlusion of the distal left circumflex coronary artery. The culprit lesion was successfully treated with primary implantation of a 3.5×15 mm Multi-Link stent (Guidant Advanced Cardiovascular Systems, Inc. Temecula, California, USA). CAG also revealed a 90% stenosis of RCA, which was located distal to two proximal severely tortuous segments (Figure 1A, 1B). Fifteen days later, staged-PCI for the RCA lesion was attempted.

Despite the combined use of a 0.014 inch Hi-Torque Balance Middle Weight guidewire (Guidant Advanced Cardiovascular Systems, Inc. Temecula, California, USA) and a Transit infusion catheter (Cordis), we failed to pass the guidewire through the tortuous proximal segments. By changing the guidewire to a 0.014 inch Choice-PT wire (Boston Scientific Scimed, Inc. Maple Grove, MN USA) we succeeded in passing the guidewire through the tortuous segments and target lesion. The Transit infusion catheter was advanced to a point just proximal to the target lesion, and then the wire was changed to the above-mentioned Balance Middle Weight wire again in order to minimize the risk of coronary perforation by the Choice-PT wire during the complex procedure. After removing the infusion catheter by the technique reported by Nanto and colleagues,\textsuperscript{1} we tried to advance a 2.5 mm Metro balloon catheter (Bolton Medical, Inc. Fair Lawn, NJ, USA), but failed mainly because of the friction between the balloon catheter and proximal vascular wall. In order to straighten the tortuous proximal RCA and to improve the accessibility to the target stenosis, we decided to insert another guidewire in parallel with the Balance Middle Weight wire, a method which is

\begin{figure}[h]
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\caption{The right coronary artery in the AP-cranial projection (A) and RAO projection (B) demonstrating 90% stenosis which was located distal to two proximal severely tortuous segments.}
\end{figure}
known as the “buddy wire technique”. A 0.014 inch Hi-Torque Extra Support wire (Guidant Advanced Cardiovascular Systems, Inc. Temecula, California USA) was advanced using a Multi-functional Probing catheter (Boston Scientific Scimed, Inc. Maple Grove, MN USA). Although the tortuous proximal segments were completely straightened by this technique, CAG revealed coronary slow flow and multiple slit-like stenoses at the straightened segments (Figure 2). These angiographic alterations were accompanied by severe anginal chest pain and significant ST segment elevation of leads II, III and aVf.

Because the appearance of newly developed stenoses strongly suggested the “accordion phenomenon”, we continued the procedure while controlling the patient's symptoms with intravenous buprenorphine hydrochloride. The target lesion was dilated with a 2.5 mm Metro balloon catheter, then a 3.0×12 mm S670 stent (Medtronic, Inc. Minneapolis, MN, USA) was quickly deployed. After post-dilatation by a S670 system balloon, additional stenoses appeared at both edges of the S670 stent (Figure 3). Although coronary spasm was highly suspected, intracoronary injection of isosorbide dinitrate (ISDN) did not resolve the stenosis. We completed the entire procedure without performing additional intervention, since we believed that the accordion phenomenon was disturbing adequate delivery of ISDN to the spastic site.

Figure 2. Buddy wire technique completely straightened the tortuous right coronary artery into a simple C-shape, and slit-like stenoses appeared at the straightened segments (LAO-cranial projection).

Figure 3. After deployment of a S670 stent at the target lesion, new focal stenoses were observed at both edges of the stent (LAO-cranial projection).
Post-procedural CAG using a 5Fr angiographic catheter revealed the disappearance of both proximal slit-like stenoses and spasm at the stent edge (Figure 4). ECG changes returned to baseline soon after removal of the stiff guidewire. There was no leakage of creatine kinase after the procedure.

**DISCUSSION**

Tortuous coronary arteries often make PCI procedures very difficult. In such cases, a stiff guidewire is occasionally used to straighten the tortuous coronary arteries in order to guarantee better accessibility to the distal target lesion. However, this technique sometimes results in angiographic abnormalities such as thrombus-like or dissection-like stenosis. The first case report was introduced by Grewe, et al in 1990 and they used the term “vascular torsion”. The terms “vessel wall invagination”, “pseudo-narrowing”, “accordion effect” and “accordion phenomenon” have also been used. Mechanical stretching of tortuous vessels causes vascular deformity, endothelial wrinkling, and results in pseudo-narrowings. Simple removal of the guidewires and restoration of the original configuration of coronary arteries usually reassure the operators that such a somewhat bizarre angiographic appearance is neither a new lesion, thrombus nor vascular injury. Since such an accordion phenomenon is basically benign, one must refrain from performing additional PCI for these lesions.
This case had extremely tortuous, corkscrew-like segments at proximal and mid segment of RCA, both of were which located proximal to the target lesion. Since mechanical correction of such anatomical features was inevitable in order to complete the PCI procedure in this case, we proceeded to the buddy wire technique using an additional support type guidewire. Two parallel guidewires completely straightened the tortuous segments and rearranged the RCA into a simple C-shape. This maneuver, however, led to coronary slow flow and transmural myocardial ischemia. Since we recognized that the angiographic alteration could be caused by the accordion phenomenon, we quickly deployed an S670 stent at the target lesion. Postdilatation provided two new stenoses at both ends of the stent. Although these stenoses were not resolved by intracoronary ISDN injection, we decided to end the procedure at this point because the angiographic appearance of these new lesions suggested simple coronary spasm and not coronary dissection. Interestingly, withdrawal of the two guidewires resolved all problems; slow flow, ECG changes, coronary spasm around the stent, and anginal symptoms.

We have never experienced this kind of severe accordion phenomenon nor have we seen any such reports.

In conclusion, we have described a very rare case in whom a severe accordion phenomenon caused transient transmural myocardial ischemia.

**REFERENCES**
