



Atypical Incomplete Detachment Following PulseRider Deployment

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Objective: Owing to the limited time since the introduction of the PulseRider (PR), inconsequential or rare complications that clinicians should be aware of remain unreported yet. Here, we report a rare complication of incomplete detachment.

Case Presentation: A 50-year-old male underwent PR-assisted coil embolization for a basilar tip aneurysm. Coiling was completed, and the detachment procedure was performed using a detachment machine; the success signal was observed. The delivery microcatheter was subsequently advanced back up to the proximal markers, and no reapproximation of the proximal markers, which indicates successful detachment, was observed. However, only one of the proximal markers returned to the microcatheter, and incomplete detachment of only one leg was detected. Ultimately, electrical detachment was not possible, and physical separation by tension was achieved.

Conclusion: Our case report presents a rare case of a detachment problem in the PR. The PR could not be detached, although the signal revealed successful detachment. Therefore, careful withdrawal of the delivery wire by checking not only the proximal markers but also the behavior of the entire PR and coil complex is important.

Keywords ▶ PulseRider, complication, case report, rare

Introduction

The PulseRider (PR) (Johnson & Johnson, New Brunswick, NJ, USA) is an innovative device for assisting in the embolization of bifurcation aneurysms. Conventionally, for the treatment of wide-neck aneurysms, multiple stents, including X and Y configurations, are required and the periprocedural ischemic complication rate has been shown to increase in such complex cases.^{1,2} With the introduction of PR, wide-neck aneurysms are treated with lesser metal coverage of the parental artery, and improvement of the ischemic complication is expected, with early experiences

by multiple center registries having widely demonstrated the safety and efficacy of PR.^{3,4} However, as the time period from the approval of the PR has been short, inconsequential or rare complications are yet to be reported. Here, we report a rare complication in which the PR could not be detached completely.

Case Presentation

A 50-year-old male was previously diagnosed with a basilar-tip aneurysm via a medical check-up, and his status was monitored annually as an outpatient. Follow-up magnetic resonance angiography revealed enlargement of the maximum aneurysm diameter from 4 mm to 6 mm, and PR-assisted coil embolization was performed. Angiography revealed an aneurysm with a 6-diameter and a 5-mm neck. The PR T-type was deployed to the acceptable neck position, and complete occlusion of the aneurysm was achieved with 10 coils (**Fig. 1**). The detaching procedure was conducted twice, with the detaching machine confirming successful complete detachment by the green light and intermittent beep for the first procedure, and cancellation of the detachment by a long beep and red flashing signal for the second procedure. On advancing the microcatheter

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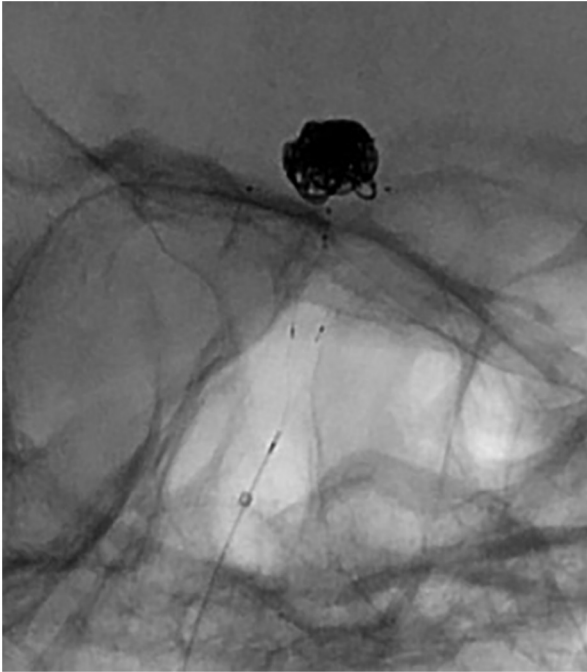


Fig. 1 Fluoroscopic image following PR deployment and coil embolization. Complete occlusion was achieved using ten coils. PR: PulseRider

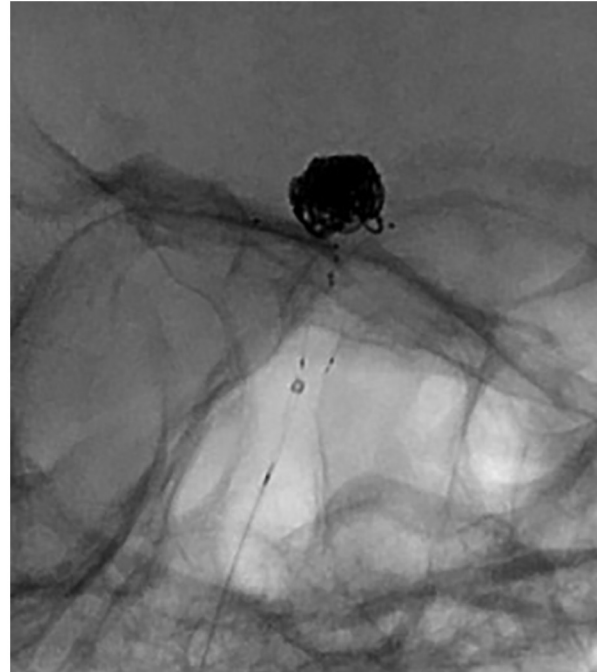


Fig. 2 Fluoroscopic image demonstrates that no reapproximation of the proximal markers was observed in advancing the microcatheter. A successful detachment was determined.

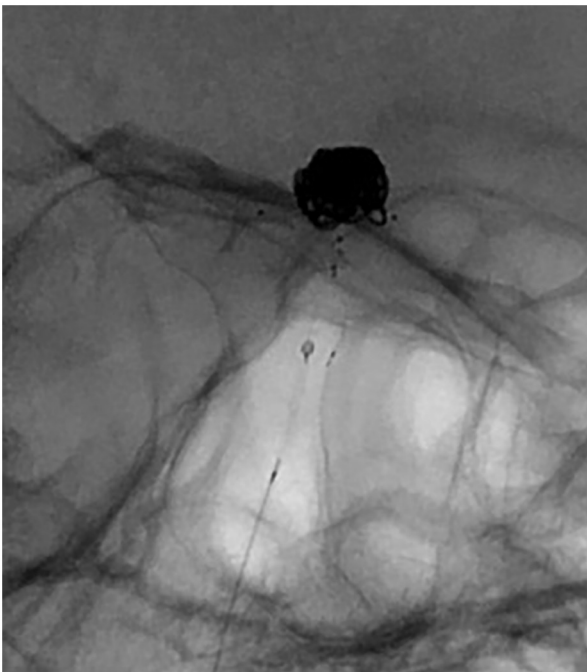


Fig. 3 Fluoroscopic image of the incomplete detachment of the PR. The tip of the microcatheter captured only one of the PR legs. PR: PulseRider

back up to the PR to verify the detachment, no reapproximation of the proximal markers was observed, and a successful detachment was ascertained (**Fig. 2**). However, the

PR moved slightly on withdrawal of the delivery wire of the PR, and the detachment procedure was repeated. Nevertheless, the detaching machine confirmed cancellation of the detachment by the same signs, and effective current was not generated. Only one of the proximal markers returned into the microcatheter, and incomplete detachment of only one leg was observed (**Fig. 3**). The electronic generator and cable were changed, and the detachment procedure was repeated for an additional two times; however, both the procedures were judged as cancellation of the detachment by a long beep and a red flashing signal. Physical detachment of the PR was accomplished by repeatedly pushing the delivery wire and pulling back to the natural position to the extent that the PR did not move. Finally, the procedure was completed without any protrusion of the coil complex or any symptomatic complications.

Discussion

In our case report, we present a case in which the detaching machine of the PR displayed the signal of complete detachment; however, incomplete detachment occurred with only one leg being detached completely. Considering the verification of the detachment, monitoring the absence of reapproximation of the proximal markers was recommended,

per the product description, when advancing the microcatheter back up toward the connecting point.⁵⁾ However, in case of incomplete detachment of one leg, as in the present case, no reapproximation could be observed. Such a case is very rare, but overlooking it could result in the protrusion of the already deployed coil and catastrophic thromboembolic events.⁴⁾ Careful observation of not only the proximal markers but also the total markers and coil mass, and careful withdrawal of the delivery wire are essential.

The efficacy of the PR in bifurcating aneurysm is no doubt, especially in the difficult cases of navigating the microcatheter to the distal branches.^{3,6)} Previously reported complications of PR have been limited to aneurysmal rupture, vessel dissection, and thromboembolic events, which are not specific to the PR procedure but typical of the neuroendovascular procedures.^{4,7,8)} Inconsequential or rare complications in individual cases, which should be carefully recounted, remain undocumented yet. To our knowledge, this is the first report of a detachment problem when using PR. The detachment issue might be caused by tangling of the detached point or the minor product defect; however, this might be a minor possibility. The cause of the detachment issue in this case report is not clear. Since the PR is the only device that has multiple detachment points, detachment complications may be more likely to occur slightly than coil detachments. Moreover, the overall impact was greater than the coil detachment issue since the PR detachment was recommended following completion of the coiling to prevent sagging of the coil or the PR.⁵⁾

The most important thing in the PR detachment issue is to notice the atypical incomplete detachment by careful observation. When the detachment failure was observed, considering the measurement based on the signal from the detachment machine without operating the wire of PR is important. The signals from the detachment machine present three patterns. The first consists of continuous green signals and intermittent beeps, which indicates the success of the detachment of the PR. The second consists of a continuous red signal and a long beep, indicating the detachment failure despite the effective current. In this pattern, the PR detaches by repeating the detachment procedure. The last one consists of a flashing red signal and a long beep. This indicates that the electric circuit is not valid. The condition of an already complete detachment, hindrance in connection, and defect of the detachment machine or connecting cable are signaled. In this pattern, the current is not generated, and repeating the procedure is impractical. It may be effective for reconfirming the detachment circuit is

connected correctly or to replace it with a new one. When the detachment could not be achieved despite every effort of the electrical way, wire operation should be tried, but easy pulling carried a risk of the PR sagging and coil protrusion. Therefore, it was important to repeat pushing the delivery wire and pulling back to the natural position to the extent that the PR did not move. Considering the series of signals in the present case, it was assumed that the PR was detached by the first detaching procedure. As the detachment mechanism was the electrolysis of the connecting point, the detachment point did not penetrate once separation was achieved. Therefore, the PR was stuck to the delivery wire unrelated to the detachment point. Conclusively, complete detachment could be achieved by physical separation of the sticking point.

Conclusion

We present a rare case of a detachment complication with the PR. In this case, although the signal indicated successful detachment, and detachment was confirmed by the observation of no reapproximation of the proximal markers, the PR could not be detached. Therefore, careful withdrawal of the delivery wire by checking not only the proximal markers but also the behavior of the entire PR and coil complex is crucial.

Disclosure Statement

The authors declare that there are no conflicts of interest.

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