A
ing increasing tendency for the endovascular man-
gagement of intracranial aneurysms emerged after
the results of the recent multicenter study com-
pareng endovascular coil occlusion and neurosurgical
therapy had shown lower morbidity and mortality rates
of endovascular treatment. However, aneurysms that
have a complex shape or a bad angle with the parent
artery as well as wide-necked aneurysms still remain a
therapeutic challenge with a much higher risk of aneu-
rysm recurrence. One of the endovascular strategies in the manage-
ment of wide-necked aneurysms is a “balloon remodel-
ing technique,” in which a small balloon on a second
microcatheter is inflated temporarily to protect the par-
et artery lumen during coil deployment within the aneu-
rys. Despite previously reported successful results of
this technique, endovascular treatment of com-
plex wide-necked aneurysms in small arteries remains a
fundamental problem. Baldi et al. reported the use of
a more compliant/super-compliant balloon (HyperForm,
ev3 Inc.) in the treatment of complex wide-necked distal
bifurcation aneurysms in which a regular and less com-
pliant balloon would not have conformed to the anatomy
and showed the feasibility of this technique. The use of
this super-compliant balloon in the treatment of 16 wide-
necked aneurysms located on an arterial bifurcation and/
or a small artery was reported by Lubicz et al.
HyperForm balloon-assisted occlusion of wide-necked aneurysms

In this article, we report our 7 years of experience with HyperForm balloon-assisted coil embolization of 864 consecutive distal bifurcation aneurysms located in the anterior circulation—that is, at the MCA bifurcation, ACoA, and distal ACA—assessing the benefits of the technique in terms of clinical outcome and treatment durability. The purpose of this article, reporting on this large series, is to discuss whether the balloon remodeling increases the risk of endovascular treatment and ultimately if the balloon remodeling brings any benefit to the endovascular aneurysm treatment.

Methods

During the period 2001–2008, the authors used a HyperForm balloon-assisted coiling technique to treat 864 aneurysms located at the MCA bifurcation (453 aneurysms), ACoA (385), and distal ACA bifurcation (26) in 800 patients (336 male, 464 female) by means of an endovascular approach. The patients’ ages ranged from 17 to 82 years (mean 53 years). Initially, in our experience with HyperForm, balloon assistance had been indicated either to protect a branch close to the aneurysm neck or to reconstruct wide necks of the aneurysms (Fig. 1). However, as we recognized the strong benefits of HyperForm remodeling in our evolving experience, we started to use this technique in our center not only in the wide-necked aneurysms but also in all cases in which it was possible. In the patients who had severe vasospasm proximal to the aneurysm, the HyperForm balloon was used initially to perform angioplasty to be able to reach the aneurysm neck; then the same balloon was used for neck remodeling (Fig. 2). In some cases in which there was severe vasospasm that did not resolve despite the intraarterial vasodilating agents and/or balloon angioplasty, the narrow lumen of the parent artery hindered the placement of 2 microcatheters at a time, therefore balloon remodeling could not be used. Another situation in which balloon remodeling was not feasible was when the guidewire of the balloon catheter changed the course of the branch considerably, resulting in flow arrest in that particular artery due to vessel stretching.

Clinical data and angiograms were reviewed retrospectively in all cases. Of the 800 patients, 647 presented with SAH (Hunt and Hess Grades I–II in 578 patients and Grades III–IV in 69). The patients, who were referred to us with acute SAH, were treated within the 24 hours of their admission to our hospital. Aneurysm sizes were not ed and classified as small (< 1 cm), large (1–2.5 cm), and giant (> 2.5 cm). Of these aneurysms, 843 were small, 19 were large, and 2 were giant. Of the 843 small aneurysms, 512 had a neck diameter equal to or wider than 4 mm.

Heparin was administered as soon as the introducer sheath was inserted, starting with a bolus dose of 5000 U and then following that with a continuous infusion to achieve and maintain an activated clotting time 2–3 times the baseline value.

On the basis of the images generated by 3D rotational acquisition and lately by maximum intensity projections of DynaCT angiography (Axiom Artis dBA, Siemens Medical) acquisition, when necessary in some selected cases, usually 2 working projections that gave the best achievable view of the aneurysm neck were defined. To control the neck of the aneurysm, the HyperForm balloon (ev3 Inc.) was placed in the appropriate bifurcation vessel as described in Fig. 3, bridging the neck of the aneurysm under simultaneous biplanar roadmapping. For endovascular coiling, a 10 microcatheter was used to catheterize the aneurysms, and coil placement was performed while the balloon was inflated temporarily as previously described.38 Balloon occlusion time during coil placement was generally not any more than 90–120 seconds, except when an intraproductive aneurysm rupture developed; in the event of rupture, the balloon occlusion time might be extended up to 4–5 minutes to control the bleeding with fast coil packing using instantaneous detachment systems. If a loop of coil was seen outside the sac on the roadmap images, we continued fast packing while keeping the balloon inflated to secure the aneurysm. All aneurysms in this series were packed with bare platinum coils. In most of the cases, a single 6 Fr guiding catheter was used if the balloon catheter and 10 microcatheter were introduced through the ipsilateral ICA. In some of the ACoA and distal ACA aneurysms, 2 guiding catheters were placed in ICAs, bilaterally, when one of the catheters had to be placed through the contralateral ICA.

In 37 aneurysms, remodeling was performed with 2 HyperForm balloons because a single balloon was not deemed to be adequate to control and reconstruct the neck of the aneurysm (Fig. 4). Thirty-two of these aneurysms were located at the MCA bifurcation and 5 were at ACoA. In these patients, either two 6 Fr guiding catheters were introduced into both ICAs via a bifemoral approach or a single 6 Fr Pinnacle Destination long guide sheath (Terumo Inc.), the inner lumen of which was large enough to harbor 2 HyperForm balloon catheters and a 10 or 14 microcatheter, was placed via a single femoral artery approach. A single 6 Fr guide sheath was preferred when both balloon catheters and the microcatheter could be introduced from the same ICA. Two guiding catheters were used if anatomical considerations necessitated placement of one of the balloon catheters through the contralateral ICA while the other balloon catheter and the microcatheter were being placed through the ipsilateral ICA.

The aneurysm occlusion rate was noted in the posttreatment angiograms. The angiographic results were classified according to the Raymond scale,35 with Class 1 defined as complete occlusion (total), Class 2 as residual neck (subtotal occlusion), and Class 3 as residual aneurysm (incomplete occlusion).

All the adverse events are reported in the present article even if no clinical consequence was observed. Neurological complications were classified as procedure related and disease related in the patients treated after SAH. Procedure-related complications were categorized as thromboembolic or hemorrhagic events. The thromboembolic complications requiring thrombolytic agents and/or causing persistent symptoms were referred to as “significant” in this series. Nonneurological complications such as cardiopulmonary complications were noted separately.

Excluding 57 patients who died and 17 patients who
were lost to follow-up, late clinical and angiographic follow-up could be obtained for 757 aneurysms (87.6%) in 726 patients (90.8%). Six-month follow-up angiograms were obtained in all of these 726 patients. At the time of this writing, the most recent control angiograms were obtained at 6 months in 386 aneurysms, at 1 year in 267 aneurysms, and at 2 years in 104 aneurysms. Additionally, MR angiograms were obtained at 5 years after treatment in 32 patients. Clinical outcome was graded according to the mRS.

Results

Significant thromboembolic complications occurred in 15 aneurysms (1.7%), which resolved completely with intraarterial and/or intravenous tirofiban infusion with no clinical consequence in 5 patients. In the remaining 10 patients (1.3%), thromboembolic complications resulted in permanent neurological deficit or death.

Hemorrhagic complications (intraoperative perforation) occurred during the coiling of 14 aneurysms (1.6%). Bleeding was controlled with a HyperForm balloon in all 14 cases. In 11 of these cases, the patients suffered no adverse consequence; 2 of the patients in the remaining 3 cases died and 1 had permanent morbidity.

Fifty-seven patients died (7.1%): 11 of the deaths were due to procedure-related complications (for a rate of 1.4%) including 1 retroperitoneal hematoma; 43 deaths were disease related (due to SAH); and 3 deaths (in patients with SAH) were due to nonneurological complications (myocardial infarction in 2 patients, and adult-type respiratory distress syndrome in 1 patient). There was only 1 complication clearly related to the use of a HyperForm balloon in this series. This complication was a dissection of the superior trunk of the MCA due to balloon inflation, resulting in vessel occlusion and neurological deficit at discharge with a full recovery 6 months after treatment.

In total, 71 patients had neurological deficits at discharge (8.9%). Of these 71 patients, 36 showed good recovery with an mRS score lower than 2, and 35 had an mRS score of 2 or higher (4.4% of the total patient group) 3–6 months posttreatment.

Neither early nor late rebleeding was observed in this series. The immediate posttreatment angiograms showed Class 1 occlusion in 631 (73%) of 864 aneurysms, Class 2 occlusion in 176 (20.4%) of 864 aneurysms, and Class 3 occlusion in 57 (6.6%) of 864 aneurysms. The results of immediate posttreatment angiograms in the group of patients in whom we had later follow-up studies for comparison (726 patients with 757 aneurysms) were as follows: Class 1 occlusion was achieved in 545 (72%) of 757 aneurysms, Class 2 occlusion in 158 (20.9%), and Class 3 occlusion in 54 (7.1%).

Six-month follow-up angiograms were obtained in all 757 aneurysms in 726 patients who were available for

![Fig. 1. A–C: Initial diagnostic right ICA angiogram (Towne [A], lateral [B], and working [C] projections) demonstrating a ruptured wide-necked MCA bifurcation aneurysm.](image-url)

D: Nonsubtracted view showing how the HyperForm balloon reconstructs the MCA bifurcation. E: Postembolization angiogram exhibiting complete occlusion of the aneurysm. F and G: One-year follow-up angiograms (subtracted [F] and nonsubtracted [G]) showing stable complete occlusion.)
follow-up. Of the 545 aneurysms in which the occlusion was initially classified as Class 1, 36 aneurysms converted to Class 3, and 6 aneurysms to Class 2 at the 6-month follow-up. Of the 158 aneurysms in which the occlusion was initially classified as Class 2, 102 aneurysms converted to Class 1, 47 aneurysms converted to Class 3, and 9 remained unchanged at the 6-month follow-up. Of the 54 aneurysms initially classified as Class 3, 14 converted to Class 1, and 16 to Class 2 at the 6-month follow-up (Table 1). Overall, recanalization occurred in 89 (12%) of 757 aneurysms, whereas spontaneous further thrombosis occurred in 132 (17%); 536 (71%) of 757 aneurysms remained unchanged in the 6-month control. Including the 6-month interval changes, the final 6-month control results were as follows: 619 (82%) of the aneurysms showed total occlusion (Class 1); 31 (4%) showed residual neck (Class 2 occlusion), and 107 (14%) had aneurysm residuum (Class 3 occlusion). Thirty-one aneurysms with initial Class 2 occlusion stayed unchanged at 1 and/or 2 years’ control angiography. Of the 107 aneurysms with Class 3 occlusion at 6 months posttreatment, 68 aneurysms were retreated (9% of 757) without any morbidity or mortality, and 39 aneurysms are still being followed up.

All regrowths but one were observed in 6-month control angiograms. In one large partially thrombosed MCA aneurysm, the 6-month angiogram showed Class 1 occlusion; however, regrowth developed in 1 year and retreatment was necessary.

In the subgroup of 37 aneurysms (4 ruptured and 33 unruptured) that were coiled with double HyperForm remodeling, there was no procedural complication. No permanent morbidity developed after treatment. One patient died as a result of a disease-related problem (SAH). One patient had a late thromboembolic event after discharge from the hospital but did not have any resultant neurological deficit. There was no permanent morbidity in this
subgroup. Of the 35 aneurysms (in 35 patients) available for follow-up studies, Class 1 occlusion was observed in 33 aneurysms and Class 2 occlusion in 2 aneurysms at posttreatment angiography. The 6-month follow-up angiograms showed Class 1 occlusion in 34 aneurysms and Class 3 in 1 aneurysm.

**Discussion**

Since it was first introduced by Moret et al. in 1997,28 the balloon remodeling technique has been efficiently used and widely accepted3,10,20,28,30 in the endovascular treatment of wide-necked complex cerebral aneurysms. Lesions treated in most of these series were sidewall ICA aneurysms. Low-compliance, oval, guide-dependent balloons like the HyperGlide balloon microcatheter (ev3 Inc.) can be safely used in such aneurysms, as in our department. However, these balloons do not have enough compliance and suppleness to adapt to the anatomy of an arterial bifurcation and be used in small arteries.21

Preliminary clinical experiences, reported previously in 2 small series,4,21 with a new, more compliant balloon microcatheter (HyperForm) concluded that this balloon was very useful for the treatment of difficult wide-necked intracranial aneurysms located on arterial bifurcations or small arteries which were considered unfavorable for coil placement with the standard technique. HyperForm is a super-compliant nonlatex balloon that adapts its shape to the anatomy of the arterial bifurcation, and with its super-compliance and suppleness, may change its shape to bulge into the origin of the branches coming off the aneurysm neck. The HyperForm balloon can take the shape of the bifurcations even if its tip is directed into one of the bifurcation branches (Fig. 3), or it can also be kept just at the neck or bifurcation during endosaccular packing without bypassing the aneurysm neck as in the round balloon technique.7 Moreover, compared with the round balloons that are not guide dependent, the HyperForm balloon is more stable when inflated because of its microguidewire.21
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In our department, aneurysms located at bifurcations or small arteries distal to the ICA are treated using the HyperForm balloon whenever technically possible. We believe that remodeling offers many advantages over standard coiling in distal bifurcation aneurysms. It provides reconstruction of the bifurcation (Fig. 1) with the protection of the parent artery and the branches adjacent to or even coming off the aneurysm neck, because it prevents the coil from bulging into these vessels. This also ensures creation of better coil conformation and results in safer and denser packing. The reconstruction of the neck can be recognized even in small aneurysms in magnified views (Fig. 5). Another very important advantage of balloon remodeling is during an intraoperative rupture; immediate inflation of the HyperForm balloon at the neck with fast coil packing stops the bleeding and could save patients from a devastating outcome. Our experience with such a case led us to use the HyperForm balloon for coiling of all acutely ruptured aneurysms regardless of aneurysm neck size whenever possible, as described in Methods. In addition to this issue of safety, it also stabilizes the microcatheter in the aneurysm during coil delivery and moreover, with the aid of the balloon, the microcatheter tip can be left just in the entrance of the aneurysm sac, when necessary, in the acute SAH cases. Coil conformation in the aneurysm being easier in such situations, catheter tip repositioning is avoided which is frequently required during simple coiling in many instances. These features are especially important when coiling an acutely ruptured small, shapeless aneurysm with very tight angulation to the parent artery (Fig. 5).

The aim of coil embolization in endovascular treatment of intracranial aneurysms should be achieving complete and stable occlusion to prevent recanalization and the risk of reblooding. Incomplete packing is one of the most important factors associated with recurrences, because of coil compaction. In those aneurysms with a large neck size or complex configuration, a coil loop may protrude into the parent artery or to the origin of side branches adjacent to the parent artery. Moreover, delineating the vessel origin in relationship to the aneurysm neck may be difficult despite multiple angiographic pro-

**Fig. 4.** A and B: Initial diagnostic angiogram (A) and 3D reconstruction image (B) showing a very wide-necked left MCA aneurysm for which a single balloon was deemed inadequate to control and reconstruct the neck. C and D: Subtracted angiogram (C) and nonsubtracted view (D) demonstrating coil packing of the aneurysm with the assistance of 2 separate HyperForm balloons placed through the superior and inferior trunks, reconstructing the aneurysm neck. E and F: Immediate postoperative nonsubtracted (E) and subtracted (F) angiograms showing complete occlusion of the aneurysm with the preservation of both MCA trunks. G: One-year follow-up angiogram revealing stable complete obliteration of the aneurysm.
al.37 presented data pertaining to 71 aneurysms treated that only the cases from the early part of the learning complications and type of balloons the authors used were not simple coiling and only 26 aneurysms were treated with complications, including an intraprocedural perforation, an 8.4% rate of procedural complications, 15 (1.9%) of 29 experienced thromboembolic complications, and 14 (1.7%) experienced hemorrhagic complications. These rates compare favorably with the results of previous large studies comprising mainly cases treated without balloon use. In the cases of thromboembolic events, intraarterial and/or intravenous tirofiban infusion was used, and the thrombi were resolved completely with no clinical consequence in 5 patients. The HyperForm balloon itself was also useful in disintegration of the thrombi in some of the cases. In the cases of intraoperative rupture, the balloon inflation aided in the control of bleeding and 11 of the 14 patients who suffered an intraoperative perforation survived with no clinical sequelae. The overall mortality rate due to procedural complications was 1.4% in this series.

Among the previous large series, Murayama et al. reported in their group of 916 aneurysms, approximately half of which were ruptured, an 8.4% rate of procedural complications, including an intraprocedural perforation rate of 2.3% and thromboembolism rate of 4.4%. Henkes et al. reported on their series of 1811 aneurysms, both ruptured and unruptured, treated by any endovascular means, but the majority by simple coiling (and balloon remodeling used in only 1.4%). The procedural mortality rate was 1.5%, the mortality rate from other causes 3.1%, the procedural morbidity rate 5.3%, and the morbidity rate from other causes 12.6%. Gallas et al. reported the results of a multicenter study including 705 ruptured aneurysms (the balloon use rate was 6%). The overall mortality rate was 11.4%, the procedural mortality rate was 1.4%, and the overall morbidity rate was 8.6%. The rate of intra procedural aneurysm rupture was 3.6% and the rate of thromboembolic events was 5.2%. It is apparent that the morbidity and mortality rates in our series of balloon were treated with balloon assistance during a 10-year period when a total of 827 aneurysms were treated. Moreover, the material selection is also very important, and the balloons that were used in their series were a B Alt balloon glued onto a No. 1.8 microcatheter, an Endeavor balloon (Boston Scientific), the Solstice balloon occlusion system (Medtronic MIS), and the Sentry balloon (Boston Scientific), none of which are as compliant as the HyperForm balloon. In their paper, Sluzewski et al. made some strong statements regarding balloon remodeling despite their very limited relevant experience. Specifically they asserted that mean packing densities were lower in balloon remodeling cases, resulting in higher incomplete occlusion rates in 6-month follow-ups. (The rates were 27.7 and 16.9%.) They also asserted that the balloon remodeling technique carried a higher risk of intraoperative rupture and thromboembolic event. Finally, the authors concluded that balloon remodeling was associated with a higher complication rate and should be reserved for the cases in which conventional coil embolization is impossible or fails and anticipated surgical risks are too high. They suggested that surgery should be the first choice if an aneurysm has a wide neck or if an aneurysm is large.

Our series, however, clearly shows that balloon remodeling does not impose additional risk to the patient even in the small distal anterior circulation vessels. Of our 800 patients, 29 (3.6%) experienced procedural complications: 15 (1.9%) of 29 experienced thromboembolic complications, and 14 (1.7%) experienced hemorrhagic complications. These rates compare favorably with the results of previous large studies comprising mainly cases treated without balloon use. In the cases of thromboembolic events, intraarterial and/or intravenous tirofiban infusion was used, and the thrombi were resolved completely with no clinical consequence in 5 patients. The HyperForm balloon itself was also useful in disintegration of the thrombi in some of the cases. In the cases of intraoperative rupture, the balloon inflation aided in the control of bleeding and 11 of the 14 patients who suffered an intraoperative perforation survived with no clinical sequelae. The overall mortality rate due to procedural complications was 1.4% in this series.

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### Table 1: Six-month follow-up angiography results in comparison with immediate posttreatment angiography results

<table>
<thead>
<tr>
<th>Initial Result</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>503*</td>
<td>6</td>
<td>36</td>
<td>545</td>
</tr>
<tr>
<td>Class 2</td>
<td>102</td>
<td>9*</td>
<td>47</td>
<td>158</td>
</tr>
<tr>
<td>Class 3</td>
<td>14</td>
<td>16</td>
<td>24*</td>
<td>54</td>
</tr>
<tr>
<td><strong>Total (%)</strong></td>
<td><strong>619 (82)</strong></td>
<td><strong>31 (4)</strong></td>
<td><strong>107 (14)</strong></td>
<td><strong>757</strong></td>
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* Stable degree of occlusion.
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remodeling are not any worse, if not favorable, than those reported in previous studies, although there are many differences between the series. Still, our series is a large one and presents considerable experience with the balloon remodeling technique.

Besides balloon remodeling, there exist other advanced reconstructive endovascular treatment strategies involving the use of intravascular stents combined with coils and/or liquid embolic Onyx and the exclusion of cerebral aneurysms from the circulation using covered stents. All these strategies are applicable in more proximal aneurysms like those located on the ICA, however distal locations are not suitable for most of these techniques. There have been a limited number of publications on the use of self-expandable neurostents in combination with coating in the treatment of aneurysms distal to the ICA. An advantage of balloon remodeling over stent-assisted techniques in the treatment of aneurysms is that it does not require antithrombotic or antiaggregant therapy following treatment, as in the stent-assisted techniques, and the use of these agents may be a concern especially in ruptured aneurysms. However, with the introduction of the self-expanding neurostents and the subsequent improvements in the technology, more and more distal aneurysms could be treated using self-expanding stents in conjunction with coating, as is currently occurring in our practice.

Our series is also unique in that it is composed of only anterior circulation aneurysms distal to the ICA (aneurysms of the MCA bifurcation, ACoA, and distal ACA), and with respect to location, there is no comparable series in the English literature to make a precise comparison. To our knowledge, there have not been many series reporting endovascular treatment results exclusively in these particular locations. However, our series clearly shows that coil embolization with the assistance of balloon remodeling is a safe treatment technique in distal bifurcation aneurysms, and the use of the supercompliant balloon definitely broadens the extent of endovascular treatment and decreases the need for surgery in these locations. Moreover, it increases the safety of the procedure via augmenting our understanding of anatomy in complex cases and enabling flow control in the event of an intraoperative rupture. Even in the subgroup of 37 aneurysms that were coiled with double HyperForm remodeling in this series, no procedural complication occurred. Although 2 balloons are only needed in a limited number of cases and this technique entails some technical challenges (to be detailed in another article), very satisfactory results can be achieved (Fig. 4).

Regarding the efficiency of the balloon remodeling technique in distal locations, the immediate posttreatment results in our series were Class 1 occlusion in 73% of aneurysms, Class 2 in 20.4%, and Class 3 in 6.6%. The follow-up angiograms, which were obtained in 87.6% of the patients, revealed a recanalization rate of 12% and further thrombosis in 17%, resulting in complete obliteration (Class 1 occlusion) in 82%; the retreatment rate was 9%. Although this series included many wide-necked and so-called “surgical aneurysms” (aneurysms that could not be treated without balloon remodeling), the long-term results were still comparable to those of previously

Fig. 5. A: Initial angiogram showing an acutely ruptured, very small distal ACA aneurysm with very tight angulation to the parent artery. B: Roadmap view showing the placement of the HyperForm balloon catheter bridging the neck of the aneurysm. C: Nonsubtracted view demonstrating endosaccular coil packing while keeping the balloon inflated. D and E: Nonsubtracted (D) and subtracted (E) angiograms showing complete occlusion of the aneurysm with a reconstructed neck. F: One-year follow-up angiogram revealing complete obliteration of the aneurysm.
published series (recurrences varying between 14.7 and 36.4%; retreatment between 4.7 and 20.8%), if not any better.12,33

Conclusions

The super-compliant HyperForm remodeling balloon can be safely and very effectively used for distal bifurcation aneurysms with no concern of increasing the complication rate. It not only increases the feasibility of the endovascular treatment but also the safety of the procedure.

Disclosure

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References

28. Moret J, Cognard C, Weill A, Castaing L, Rey A: Recon-
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Address correspondence to: H. Saruhan Cekirge, M.D., Hacettepe University Hospitals, Department of Radiology, 06100 Sihhiye, Ankara, Turkey. email: seekirge@gmail.com.