INTRAORTIC BALLOON ENTRAPMENT
— A Case Report and a Review of the Literature —

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A case of intraaortic balloon entrapment is reported. To our knowledge, this is the tenth case in the literature. We conclude that balloon entrapment can occur without any signs of rupture of the balloon and that the balloon should be removed surgically.

Balloon rupture is a rare complication of intraaortic balloon pumping (IABP), with an incidence of 0.12 to 2.4 per cent.2 Extremely rarely, balloon rupture causes balloon entrapment due to clot formation inside the balloon. To our knowledge, only nine such cases have been reported.

We report a case of intraaortic balloon entrapment, review the literature and discuss some of the problems.

CASE REPORT

A 70-year-old man with a history of anterior myocardial infarction was admitted on Nov. 16, 1988 because of frequent ischemic episodes starting three months earlier. Cardiac catheterization and selective angiography revealed severe triple-vessel disease, including occlusion of the left anterior descending coronary artery, 99% stenosis of the dominant right coronary artery and 99% stenosis of the obtuse marginal branch. Echocardiography and left ventriculography showed an apical left ventricular aneurysm. He was treated with coronary artery bypass grafting and left ventricular aneurysm resection on Nov. 22, 1988. Because of difficulty in weaning him from cardiopulmonary bypass, an IABP was indicated. In the presence of arteriosclerosis obliterans which was diagnosed preoperatively by bruits in both groins, an attempt to insert an IABP percutaneously was unsuccessful. A No. 10.5 French 40 ml DataScope balloon was, with much difficulty, inserted surgically. Insertion of a guide wire for the balloon required not only exposure of the left external iliac artery but also manual guiding from outside of the artery. Furthermore, we added a femorofemoral bypass using an 8 mm expanded polytetra-fluoroethylene graft, because insertion of the IABP appeared to weaken the left femoral pulse. Thrombocyte count was $4.4 \times 10^4$/mm$^3$ and prothrombin time was 13.0 sec. Thus, no anticoagulants were given.

On the third day after balloon insertion, the console alarm suddenly indicated “Possible Helium Leak” and “High Balloon Pressure”. At that time, no blood was present in the visible tube connecting the balloon console. To remove the balloon, the left femoral artery was exposed and a large arteriotomy was made. About 10 cm of the tube was easily moved, but the more distal portion including the balloon tip was entrapped in the artery. It appeared risky to pull the tube with more force. The patient was transferred to the operating room, and the balloon was removed retrogradely through an...
Fig. 1. Balloon after surgical removal. There is a pinhole near the proximal seal (small arrow). The lumen is obstructed by a large hard clot (large arrow) that prevented removal of the balloon from the artery.

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Author (Date)</th>
<th>Sex</th>
<th>Age</th>
<th>Duration of IABP</th>
<th>Blood in the Tubing</th>
<th>Method of Removal</th>
<th>Balloon (Size)</th>
<th>Insertion Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ara³ (1986)</td>
<td>M</td>
<td>79</td>
<td>32 hours</td>
<td>(+)</td>
<td>Femoral arteriotomy</td>
<td>Kontron (40 ml)</td>
<td>Percutaneous</td>
</tr>
<tr>
<td>2</td>
<td>Milgarter³ (1986)</td>
<td>F</td>
<td>69</td>
<td>28 days</td>
<td>(+)</td>
<td>Femoral arteriotomy</td>
<td>Kontron</td>
<td>Percutaneous</td>
</tr>
<tr>
<td>3</td>
<td>Hirose⁵ (1988)</td>
<td>F</td>
<td>62</td>
<td>8 days</td>
<td>(+)</td>
<td>External iliac arteriotomy</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>Mukohara⁶ (1989)</td>
<td>M</td>
<td>69</td>
<td>6 days</td>
<td>(+)</td>
<td>Exposure of external iliac artery and extraction</td>
<td>—</td>
<td>Surgical</td>
</tr>
<tr>
<td>5</td>
<td>Niinami⁷ (1989)</td>
<td>F</td>
<td>62</td>
<td>5 days</td>
<td>(+)</td>
<td>Impossible</td>
<td>— (30 ml)</td>
<td>Percutaneous</td>
</tr>
<tr>
<td>6</td>
<td>Masai⁶ (1990)</td>
<td>M</td>
<td>67</td>
<td>4 days</td>
<td>(−)</td>
<td>Femoral arteriotomy</td>
<td>Datascopé (34 ml)</td>
<td>Percutaneous</td>
</tr>
<tr>
<td>7</td>
<td>Masai⁶ (1990)</td>
<td>M</td>
<td>73</td>
<td>4 days</td>
<td>(−)</td>
<td>Impossible</td>
<td>Datascopé (34 ml)</td>
<td>Percutaneous</td>
</tr>
<tr>
<td>8</td>
<td>Arikawa⁸ (1990)</td>
<td>M</td>
<td>74</td>
<td>9 days</td>
<td>(+)</td>
<td>Abdominal aortotomy</td>
<td>Datascopé (40 ml)</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>Arikawa⁸ (1990)</td>
<td>F</td>
<td>62</td>
<td>6 days</td>
<td>(+)</td>
<td>Abdominal aortotomy</td>
<td>Datascopé (40 ml)</td>
<td>—</td>
</tr>
<tr>
<td>10</td>
<td>Nishizawa (1990)</td>
<td>M</td>
<td>70</td>
<td>70 hours</td>
<td>(−)</td>
<td>Abdominal aortotomy</td>
<td>Datascopé (40 ml)</td>
<td>Surgical</td>
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</table>
abdominal aortotomy. Fogarty embolectomy yielded fresh thrombi from both femoral arteries and the abdominal aorta. There was a pinhole near the proximal seal of the balloon, and the balloon lumen was obstructed by a massive hard clot that had prevented removal of the balloon from the artery (Fig. 1).

The patient’s postoperative course was complicated by hyperbilirubinemia, but he made a complete recovery. He was discharged on the 80th day after IABP insertion.

The balloon was sent to the manufacturer (Datascope) for further examination. Their conclusion was that the membrane penetration was probably caused by repeated abrasion by calcified plaques during usage.

DISCUSSION

Balloon entrapment is an extremely rare complication of IABP caused by rupture of the balloon and subsequent clot formation inside the balloon. In our case, considering the manufacturer’s conclusion and the presence of arteriosclerosis obliterans, the balloon rupture was probably caused by repeated abrasion by calcified plaques. A similar cause was pointed out in most reports.1–5,8

Aru and colleagues1 reported the existence of a fragment of calcified atherosclerotic plaque within the clot in the balloon and postulated laceration by balloon impact against atherosclerotic plaques on insertion.

In most reports, balloon rupture was detected by the appearance of blood in the tubing1,2. In our case, no such blood was observed, and an alarm system in the console did not work. No signs of rupture of the balloon were evident until the final stage. However, there was a very hard clot 2 cm in diameter in the removed balloon. The clot did not appear to be fresh. It is thought, therefore, that the leakage of helium was so slight that the leakage alarm was not activated for a long time and that the inflow of blood into the balloon was so small that no blood flowed backward into the tubing.

A search of the literature revealed a total of nine cases of balloon entrapment3–9 (Table I). Our case is the tenth one. Blood in the balloon tubing or safety chamber was seen in seven cases and was not present in three, including the present case. Thus, balloon entrapment can occur without any signs of rupture of the balloon.

In regard to the methods of balloon removal, Mukohara and colleagues8 reported that they were fortunately able to remove the balloon entrapped in the common iliac artery with femoral arteriotomy alone and powerful traction. In this case, however, abdominal aortotomy was necessary. Retrospectively, extracting our balloon by excessive force could have torn the abdominal aorta or the iliac artery, because there was a hard clot 2 cm in diameter in the balloon and the left common iliac artery was very sclerotic.

In IABP-dependent cases, balloon entrapment is often fatal. Two cases (Cases 5 and 7) may have died of this complication.

SUMMARY

Balloon rupture is sometimes difficult to detect and subsequent balloon entrapment is occasionally fatal. We should remember that balloon entrapment can occur with no sign of rupture of the balloon. When this complication occurs, the balloon should be removed surgically.

REFERENCES