Author’s response to reviews

Title: IABP:History-Evolution-Pathophysiology-Indications:What we need to know

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Letter to Reviewer

Reviewer #2: The present review article demonstrates a historical review and mainly hemodynamic physiology of IABP, which is well written in terms of its theoretical aspect.

This subject should be written as a comprehensive review article, because IABPs have a long history and everyone knows them well. For example, the authors should summarise various complications caused by an implanted IABP, and the incidence of their complications and how to treat them should be mentioned. The complications includes platelet reduction (or thrombocytopenia), influence on coagulation/fibrinolysis system, thromboembolism of visceral arteries (celiac artery, superior mesenteric artery, renal arteries) and peripheral arteries, aortic dissection in device insertion, balloon rupture due to its contact with calcified atherosclerotic plaque (a ruptured balloon must be immediately removed, because it may not be able to be removed due to clot in the ruptured balloon), and so on.
These subjects are very important for clinicians.

Answer

Dear reviewer

An extra chapter on complications of IABP has been added as per your valuable suggestions.

Yours Sincerely

The authors

Brief summary of IABP complications

IABP complications are resulted during difficult insertion and malposition, prolong IABP stay and due to patient’s comorbidity such as peripheral vascular disease, small size patients, use of sheath of IABP and Diabetes.

A paper by Rastan et al (96) identified IABP malposition to be a common finding on post insertion CT scans. Anatomic to balloon length mismatch was found in 68.2% of the cases, with subsequently severe adverse effects.

Injuries resulting during IABP action could be overlooked unless catastrophic clinical implications are encountered; an important paper by Isner et al (97) reviewed a total of 45 necropsy patients who have had an IABP inserted and who died within 105 days of the time of balloon insertion. Dissection of the aortoiliac axis occurred in nine patients and in none of them was the dissection suspected before death. In 4 out of those 9 patients, insertion occurred without resistance. In one out of the 3 patients that they had developed arterial perforation no complication of balloon insertion had been developed. In 2 out of the 3 patients that they had developed thrombosis intravascularly no clinical suspicion rose prior to death. Clinically silent arterial emboli occurred in 3 patients. They concluded that out of the 20 complications (in 16 patients) only 4 (20%) had been suspected before death.

By enlarge, complications are reported to be primarily associated with the insertion process and prolonged balloon pumping, rather than removal or post removal monitoring.
Obviously, due to the nature of the IABP, the main complications relate to vascular injury, with studies suggesting vascular ischaemic complications of between 8-18% with major limb ischaemia reported to be less than 1% [98-102].

In a study published by our group (103), cold pulse-less foot was detected in 29.5% of the cases. The ischemia resolved either with removal of the balloon (n=18pt) or with thrombectomy (n=8pt, 5.8%). One patient developed gangrene and required amputation.

Thrombocytopenia, defined as platelets <150,000/mL or >50% decrease from baseline, occurred in 57.9% of patients.

Among patients undergoing IABP, thrombocytopenia is generally mild, appears to be unrelated to concomitant heparin use, and is not associated with an increased risk of major bleeding or inhospital death (104) (105).

Rupture of the IABP is rare but can cause gas embolism and potential entrapment of the balloon within the arterial tree. This was first reported by Rajani et al (106) however it is very rare, possibly less than 0.5%. The proposed mechanism involves mechanical disruption of the balloon against an atherosclerotic plaque or extensively calcified aortic wall with resultant perforation and the negative pressure created during deflation traps blood within the balloon. The blood rapidly reacts with the helium causing a hard clot formation, which together with the tortuous atherosclerotic aortic environment results in entrapment of a semi-deflated balloon (107).

Finally, Complications of thrombosis and infection are related to the duration of IABP therapy while the limb ischemic problems are more a function of the atherosclerotic status of the common femoral artery and either the ratio of balloon catheter diameter to arterial lumen, or the difficulty of dealing with a severely atherosclerotic artery with loose plaques or fragility requiring excessive surgical manipulation.

References


100. Saura E, Savola J, Gunn J.

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