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Management of High-Risk Obstetrical Patients with Morbidly Adherent Placenta in the Age of Resuscitative Endovascular Balloon Occlusion of the Aorta

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Abstract

Obstetric hemorrhage is the leading cause of maternal morbidity and mortality worldwide [1]. At highest risk of massive obstetric hemorrhage, are women with morbidly adherent placenta (MAP). The complications associated with MAP are even more devastating in very high-risk obstetrical patients, where blood transfusion is not an option, either due to lack of resources or patient refusal, such as for Jehovah’s Witnesses. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a minimally-invasive technique used in trauma surgery to control non-compressible hemorrhage. REBOA is emerging as useful tool for managing high-risk obstetric surgery for MAP. This review aims to provide a framework for use of REBOA in obstetric care in challenging circumstances.

Keywords: accreta, aortic balloon, balloon occlusion, Jehovah’s Witness, morbidly adherent placenta, obstetric hemorrhage, percreta, REBOA

1. Introduction

Obstetric hemorrhage is the leading cause of maternal morbidity and mortality worldwide [1]. At highest risk of massive obstetric hemorrhage are women with a morbidly adherent placenta (MAP). MAP describes the penetration of placental chorionic villi into the uterus to varying degrees classified as—placenta accreta, increta, and percreta. The incidence of MAP is increasing.
In the United States alone, the rate doubled from 5.4 in 10,000 deliveries to 11.9 in 10,000 over a period of 6 years [2]. The most severe form, placenta percreta, in which chorionic villi penetrate through the uterine wall and into adjacent organs, has increased 50-fold in the last 50 years [3].

Women with multiple prior cesarean deliveries are at greatest risk for MAP. The risk of MAP in patients after one, two, or three prior cesarean deliveries increases 2.9, 4.6 and 12.6-fold, respectively [4]. Additional risk factors include prior surgical injury to the myometrium, including dilation and curettage, and advanced maternal age.

The potential consequences of obstetric hemorrhage are most dire in women who refuse, or cannot receive, blood products. For example, the maternal mortality ratio (MMR) due to major obstetric hemorrhage in Jehovah's Witnesses was 68 per 100,000 live births in one study; 130 times that of the general population [5]. Furthermore, in low resource settings, where blood products are not readily available, the MMR can be up to 645 per 100,000 live births [6]. Obstetric hemorrhage accounts for up to 42% of maternal deaths in low resource settings [7]. With this in mind, new strategies for obstetric hemorrhage control are essential for improving transfusion-free survival.

Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging, minimally-invasive technique to control non-compressible hemorrhage. Although initially developed for the management of traumatic hemorrhage, REBOA has been gaining popularity for the control of non-traumatic hemorrhage. Early reports of REBOA use in obstetric hemorrhage indicate that the approach reduces blood loss, improves maternal outcomes, and decreases rates of hysterectomy compared to traditional techniques, such as uterine balloon tamponade, and hypogastric or uterine artery occlusion [8–10]. This review describes the potential applications of REBOA for control of obstetric hemorrhage in high-risk obstetric surgery for MAP.

High-quality evidence to inform management of obstetric hemorrhage when transfusion is not an option is generally lacking. Small numbers of patients, clinical heterogeneity, and ethical principles preclude against randomized studies, so most data are drawn from case series and case reports, as well as from physiological principles and expert opinions. REBOA is a growing modality with novel applications, as well as technical and technological improvements that are continually evolving. The application of REBOA to obstetric hemorrhage is in its infancy, thus comparative data and long-term follow-up are lacking. While this may limit the strength of any generalizations that can be drawn from the literature, this review aims to provide a framework for use of REBOA in obstetric care in this challenging circumstance.

2. Demographics of high-risk patients

Approximately 60% of women with MAP will experience significant morbidity, including blood transfusion, urologic injury, infection, intensive care unit admission, and readmission. A 15% of obstetric hemorrhage requiring blood transfusion are due to MAP [11]. The majority of patients with MAP will undergo invasive procedures, have extensive blood loss and require massive blood transfusion [2, 11]. A 90% of patients with placenta percreta who undergo cesarean hysterectomy will require blood transfusion due to intraoperative blood losses greater than three liters, with median transfusion of 7 units of red blood cells [12, 13].

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