Egyptian Journal of Anaesthesia xxx (2017) xxx–xxx

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Egyptian Journal of Anaesthesia

journal homepage: www.sciencedirect.com

Review article

Post-spinal anesthesia hypotension during cesarean delivery, a review article

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ARTICLE INFO

Article history:
Received 12 January 2017
Revised 21 March 2017
Accepted 24 March 2017
Available online xxxx

Keywords:
Hypotension
Spinal anesthesia
Cesarean delivery

ABSTRACT

Maternal hypotension is a common complication after spinal anesthesia for cesarean delivery. Prevention and treatment of post-spinal hypotension (PSH) in cesarean delivery has been frequently investigated.

Fluid loading is superior to no-fluid regimen; however, the incidence of PSH is still high with all fluid loading protocols; thus, the use of fluid loading as a sole method for prophylaxis might be not satisfactory for many anesthetists. Phenylephrine is the preferred vasopressor for prevention and management of PSH in most cases. Ephedrine may be more beneficial in patients with bradycardia, patients with uteroplacental insufficiency and pre-eclamptic patients. Norepinephrine infusion was recently investigated as an alternative for prophylaxis of PSH with minimal cardiac side effects.

The high incidence of PSH with most of the pharmacological and non-pharmacological methods suggests the need for multimodal protocols for prevention and management of this problem. PSH in cesarean delivery is a common daily situation facing all anesthetists; thus, future research should focus on simple and rapid protocols that can be easily applied by anesthetists with moderate and low experience with minimal need to complex devices or costly drugs.

Contents

Peer review under responsibility of Egyptian Society of Anesthesiologists.

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http://dx.doi.org/10.1016/j.egja.2017.03.003
1110-1849/

Please cite this article in press as: Hasanin A et al. Post-spinal anesthesia hypotension during cesarean delivery, a review article. Egypt J Anaesth (2017), http://dx.doi.org/10.1016/j.egja.2017.03.003

1. Introduction

Spinal anesthesia is the popular route of anesthesia in parturients for cesarean delivery [1]. Maternal hypotension is a common complication after spinal anesthesia resulting in adverse maternal and fetal outcomes [2,3]. Prevention and management of post-spinal hypotension (PSH) is continuously investigated [4,5]. In this article, we are giving an updated review for prevention and management of PSH in cesarean delivery. Gaps in literature, areas of unclear evidence, as well as future thoughts are also highlighted.

The basic components of management of PSH are: (1) Fluid loading. (2) Pharmacological agents. (3) Positioning protocols.

2. Fluid loading

Although the use of fluid loading regimens has been considered as a classic practice in obstetric anesthesia, recent evidence has questioned its value [3]. Some authors reported that spinal anesthesia in obstetric population is accompanied by an increase rather that decrease in cardiac output [6–8]. This finding makes fluid loading for prevention of PSH an unlikely hypothesis. Moreover, fluid loading in parturients has been reported to disrupt glycocalyx [9]. Glycocalyx is a carbohydrate-rich layer lining the endothelium that plays a role in maintaining endothelial integrity. Destruction of endothelial glycocalyx was reported as a cause for failure of fluid loading in prevention of PSH [9].

2.1. Preloading

Although crystalloid preloading is superior to the "no fluid regimen", the incidence of PSH with all preloading regimens is still high [4,5]. According to the latest Cochrane database reviews, the colloid preloading regimen may be better than crystalloid preloading [5]; however, later Randomized Controlled Studies comparing colloid and crystalloid preloading showed conflicting evidence [8,10–13].

2.2. Co-loading

The most accepted explanation for the limited value of fluid preloading is the rapid distribution of administrated fluids in the extravascular space [14]. This was the cause of the evolution of the concept of fluid co-loading where rapid fluid administration is started simultaneously with spinal block. With co-loading, fluid re-distribution might be minimized because of simultaneous vasodilatation [15].

Most studies reported that co-loading is superior to (or at least the same as) preloading when comparing the two protocols using the same type of fluid. Crystalloid co-loading is superior to crystalloid preloading [16–19] and similar to colloid preloading [20]. Colloid co-loading is not superior to colloid preloading [21–24].

With comparing fluids of different types, crystalloid co-loading was similar to colloid co-loading [25]. The fluid volume needed with colloids is less than the volume needed with crystalloids.

2.3. Goal directed fluid therapy

Many protocols of goal directed fluid therapy (GDFT) have been introduced aiming to optimize perioperative hemodynamic state and improve patient outcome. According to a recent RCT, GDFT aiming for optimization of stroke volume was associated with lower incidence of PSH compared to control group [26].

2.4. Important notes

The incidence of PSH is obviously high with all fluid loading regimens.

1. Important limitations in fluid loading studies included: the high variability in the volume regimens and other cofactors such as combination of fluids and vasopressor.
2. The only meta-analysis comparing co-loading with preloading (showing no difference between both regimens) included RCTs for both colloids and crystalloids regimens without subgroup analysis [27].
3. Most of "preload versus co-load" and "crystalloid versus colloid" studies didn't include control group that didn't receive any fluid loading regimen [16,17].

2.5. Collective evidence

With the available evidence, we could assume that fluid co-loading is preferred to preloading because it carries more success (or at least the same results) in prevention of PSH with the advantage of being less time consuming. We also suggest the use of crystalloids over colloids because of the lower cost with unclear benefit for colloids. We suggest that using fluid loading protocols is not sufficient to achieve satisfactory clinical results (Table 1).

3. Vasopressors

3.1. Choice of the vasopressor

The use of vasopressors is more widely accepted as an effective method for decreasing PSH than fluid loading [3]. Phenylephrine (PE) is preferred vasopressor in prevention and treatment of PSH because of: faster onset [7], less incidence of fetal acidosis [28], less placental passage [29], less maternal nausea and vomiting despite the similar incidence of PSH [30,31]. Norepinephrine was recently investigated as an alternative to PE with less cardiac depression with promising results [32,33]; however, more research is warranted for reaching the optimum dose. In addition to its potent antiemetic properties, ondansetron was reported as a prophylactic drug from PSH with minimal side effects [34]. Although it is less recommended, ephedrine still has a role in some situations:

Table 1
Fluid loading protocols.

Protocol	Main results	Type of study
Crystalloid preload versus no fluid regimen.	Crystalloid preload is superior [4,5]	meta-analysis
Crystalloid preload versus colloid preload	Colloid preload is superior [5]	meta-analysis
Crystalloid preload versus crystalloid co-load	Co-load is superior [16–18]	RCT
Crystalloid co-load versus colloid co-load	No difference [25]	RCT
Crystalloid co-load versus colloid preload	No difference [20]	RCT
Colloid preload versus colloid co-load	No difference [21–24]	RCT

RCT: randomized controlled trial.

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