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Mini Review: Open Access

Hemodynamic Pressor Response after Mayfield's Scalp Clamp Application during Craniotomies: Is it still a Nightmare?

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ABSTRACT

Using Mayfield's scalp clamp became mandatory in most craniotomies but it leads to potentially hazardous hemodynamic pressor effects. Many interventions like infiltration of local anesthetics at insertion sites or injecting ketamine, dexmedetomidine, clonidine and magnesium sulphate (MgSO4) had been studied to attenuate these effects. This mini review aims to highlight the efficacy of these interventions through the previously published researches.

Conclusion: These undesired pressor effects can be attenuated or even abolished using either one modality or combination of two or more.

Keywords: Mayfield's Clamp-Press or Response-Craniotomies

INTRODUCTION

In 1973, Frank Mayfield and George Kees invented Mayfield skull clamp as a head holder during intracranial operations using three sterile pins deep to the periosteum at two opposite sides of the head [1]. Nevertheless, this technique resulted in many complications which were summarized by Beuriat et al. [2] in their review. Air embolism, broken clamp, dural laceration, skull fractures, epidural hematomas, traumatic aneurysm of the superficial, traumatic middle meningeal arteriovenous fistula, temporal artery and sinus fracture with cerebrospinal fluid leak were among these complications which are potentially serious and life threatening but fortunately rare.

During our practice, the most frequent complication is the sudden sharp noxious stimulus resulting from skull clamp insertion leading to sudden rise in blood pressure and pulse rate which is hazardous for patients with co-morbidities [3,4].

Through the last decade, researchers tried to find out a suitable strategy to attenuate or abolish this undesired reflex. Use of locally infiltrated anesthetic drugs at pins' insertion sites, injection of bolus dose of opioids, administration of α_2-adrenoceptor agonists (clonidine) and deepening level of anesthesia are among these strategies. All these techniques were proved to be effective in attenuating this pressor effect but, unfortunately, some side effects may arise specially in hemodynamically unstable patients [5-9]. Recently, Elkafrawy [10] introduced a new technique using single dose of $MgSO_4$ which has been proved to cause significant attenuation of the pressor effect without any undesired side effects. After all these efforts of research; one question should be asked: Is Mayfield's scalp clamp can be used without any harmful pressor effects? Or this is still a nightmare?!

When using Mayfield skull clamp to fix head during craniotomies, scalp layers must be penetrated by pointed pins deeply to periosteum and locked at a pressure of 30 lbs. Obviously; this sharp painful stimulus elicits sympathetic and neuroendocrine responses resulting in high blood pressure and pulse rate which may – in turn- be injurious for patients with coexisting cardiac disorder, intracranial vascular disease, increased intracranial pressure (ICP) or disturbed auto-regulatory mechanism.

To attenuate this pressor effect many strategies had been studied and proved to be effective. The first described strategy was the infiltration of pins' sites before insertion with local anesthetic, Schaffranietz et al. [11] compared the effect of 1% lidocaine and 0.5% bupivacaine when injected locally at pins sites before insertion. Their study concluded

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the efficacy of both drugs without difference. Addition of vasoconstrictors as adrenaline to local anesthetic to prolong its duration of action was studied by Arshad et al. [12] who concluded that pressor effects can be effectively prevented by prior lidocaine with adrenaline infiltration of the pin insertion sites. But practically the insertion of scalp pins is usually done by junior neurosurgeons trying more than one insertion before final one which is frequently outside the range of local infiltration.

Osborn and Sebeo [13] described thoroughly the ‘‘scalp block’’ technique to alleviate pain during craniotomy and they concluded that scalp block is safe even in pediatric and effective in maintaining hemodynamic stability for intraoperative and postoperative periods. During practice, we noticed most of anesthetists refrain to block scalp for being time consuming and need for good experience.

Ketamine as a NMDA blocker was used widely as an analgesic, Agarwal et al. [14] studied subanesthetic dose of intravenous (IV) ketamine (0.5 mg/kg) and/or lidocaine infiltration (1%) prior to the pins’ insertion but they found that mean blood pressure response in the ketamine group was similar to the placebo group. This was explained by the direct effect of ketamine despite of its analgesic properties, but significant attenuation of MBP and HR was observed in the lidocaine and ketamine-lidocaine groups which they dedicated to lidocaine. Injection of bolus dose of opioids as an alternative was suggested to be helpful, Karamehemet et al. [15] and Ozkose et al. [16] compared the effects of intravenous fentanyl and intravenous fentanyl combined with bupivacaine infiltration on the hemodynamic response to skull pin insertion. Both methods attenuate the hemodynamic response to skull pin insertion. They stated that; an additional dose (1 µg/kg) of fentanyl just before skull pin insertion is recommended as a simple and effective option that requires no extra time.

Dexmedetomidine, α2 adrenoreceptor agonist, proved to have sympatholytic and antinociceptive properties that may improve hemodynamic stability during neurosurgical procedures. Paul et al. [17] compared dexmedetomidine (received as 1 µg/kg over 10 min starting at induction of anaesthesia) or/with lignocaine (received 3 ml of 2% lignocaine infiltration at pin application sites before pin application). They concluded that IV dexmedetomidine was comparable to local infiltration of 2% lignocaine at pin application sites to attenuate the haemodynamic response associated with skull pin application. Kondavagilu et al. [18] evaluated the efficacy of intravenous (IV) dexmedetomidine on attenuation of hemodynamic responses to skull pin head holder application and compared the effectiveness of two doses of IV dexmedetomidine (1 µg/kg infusion over 10 min and 0.5 µg/kg bolus). Dexmedetomidine 0.5 µg/kg was proved to be more effective in attenuating the HR and MAP response to skull pin insertion as compared to a dose of 1 µg/kg. But the use of dexmedetomidine was limited be some neuroanaesthetists because of its higher incidence of hypotension and bradycardia.

Clonidine as a selective alpha 2 receptor agonist widely used as a centrally acting antihypertensive drug was studied by Nanjundaswamy et al. [19]. They compared the effectiveness of IV clonidine infusion and IV lignocaine infusion in suppressing the hemodynamic response to skull pin head holder insertion. Lignocaine at a dose of 1.5 mg/kg as an infusion and IV clonidine 2 µg/kg are effective in attenuating laryngoscopy, intubation and pin insertion in craniotomies. They concluded that IV clonidine at the dose of 2 µg/kg is a better than IV lignocaine in attenuating these hemodynamic responses.

$MgSO_4$ as a non-competitive N-Methyl-D-Aspartate (NMDA) receptor antagonist and a calcium channel blocker has an analgesic effect either by blocking central nociceptive sensitization or reduction of catecholamine release peripherally. ElKafrawy [10] evaluated the effect of $MgSO_4$ on attenuation of hemodynamic pressor activity after scalp clamp application during craniotomies. When given as an infusion of 50 mg/kg $MgSO_4$ in 100 ml 0.9% sodium chloride over 15 min prior to anesthesia induction, it attenuated significantly this pressor activity without any undesired effects.

CONCLUSION

According to this mini review, we can conclude that no more nightmares. Many strategies were proved to attenuate the pressor effect following scalp clamp application during craniotomies. For every patient, each choice must be tailored to his/her preoperative status and anesthetist’s previous experience. More than one modality can be used; not only to attenuate but even to abolish this effect safely.

REFERENCES

1. Tew JM (1991) Frank H. Mayfield, MD; 1908-1991. J Neurosurg 75: 347-348.
2. Beuriat PA, Jacquesson T, Jouanneau E, Berhouma M (2016) Headholders’ - complications in neurosurgery: A review of the literature and recommendations for its use. Neurochirurgie 62.
3. Arshad A, Shamim MS, Waqas M, Enam H, Enam SA (2013) How effective is the local anesthetic infiltration of pin sites prior to application of head clamps: A prospective observational cohort study of hemodynamic response in patients undergoing elective craniotomy. Surg Neurol Int 4: 93.
4. Paul A, Krishna HM (2015) Comparison between intravenous dexmedetomidine and local lignocaine infiltration to attenuate the haemodynamic response to skull pin head holder application during craniotomy. Indian J Anaesth 59: 785-788.

5. Irene O, Joseph S (2010) ‘‘Scalp Block’’ during craniotomy: A classic technique revisited. J Neurosurg Anesthesiol 22: 187-194.

6. Misra S, Koshy T, Unnikrishnan KP, Suneel PR, Chatterjee N (2011) Gabapentin premedication decreases the hemodynamic response to skull pin insertion in patients undergoing craniotomy. J Neurosurg Anesthesiol 23: 110-117.

7. Uyar AS, Yagmurdur H, Fidan Y, Topkaya C, Basar H (2008) Dexmedetomidine attenuates the hemodynamic and neuroendocrine responses to skull-pin head-holder application during craniotomy. J Neurosurg Anesthesiol 20: 174-179.

8. Agarwal A, Sinha PK, Pandey CM, Gaur A, Pandey CK et al. (2001) Effect of a subanesthetic dose of intravenous ketamine and/or local anesthetic infiltration on hemodynamic responses to skull-pin placement: A prospective, placebo-controlled, randomized, double-blind study. J Neurosurg Anesthesiol 13: 189-194.

9. Vinit K, Abhishek M, Sanjay A, Sanjay K, Sunil S (2016) Comparative evaluation of dexmedetomidine and magnesium sulphate on propofol consumption, hemodynamics and postoperative recovery in spine surgery: A prospective, randomized, placebo controlled, double-blind study. Adv Pharm Bull 6: 75-81.

10. ElKafrawy SA (2019) The effect of intravenous single dose of magnesium sulphate on attenuation of hemodynamic pressor response after Mayfield’s clamp application during craniotomies. Indian J Clin Anaesth 6: 614-619.

11. Schaffranietz L, Rüffert H, Trantakis C, Seifert V (1999) Der Einfluss von Lokalanästhetika auf hämodynamische Effekte beim Anlegen der Mayfield-Klammer in der Neurochirurgie unter totaler intravenöser Anästhesie [Effect of local anesthetics on hemodynamic effects during Mayfield skull clamp fixation in neurosurgery using total intravenous anesthesia]. Anaesthesiol Reanim 24: 51-54.

12. Arshad A, Shamim MS, Waqas M, Enam H, Enam SA (2013) How effective is the local anesthetic infiltration of pin sites prior to application of head clamps: A prospective observational cohort study of hemodynamic response in patients undergoing elective craniotomy. Surg Neurol Int 4: 93.

13. Osborn I, Sebeo J (2010) ‘‘Scalp Block’’ during craniotomy: A classic technique revisited. J Neurosurg Anesthesiol 22: 187-194.

14. Agarwal A, Sinha PK, Pandey CM, Gaur A, Pandey CK, et al. (2001) Effect of a subanesthetic dose of intravenous ketamine and/or local anesthetic infiltration on hemodynamic responses to skull-pin placement: A prospective, placebo-controlled, randomized, double-blind study. J Neurosurg Anesthesiol 13: 189-194.

15. Yildiz K, Madenoglu H, Dogru K, Kotanoglu MS, Akin A, et al. (2005) The effects of intravenous fentanyl and intravenous fentanyl combined with bupivacaine infiltration on the hemodynamic response to skull pin insertion. J Neurosurg Anesthesiol 17: 9-12.

16. Ozköse Z, Yardim S, Yurtlu S, Dogulu F, Kaymaz M, et al. (2000) The effects of intravenous fentanyl and lidocane infitration on the haemodynamic response to skull placement. Neurosurg Rev 23: 218-220.

17. Paul A, Krishna HM (2015) Comparison between intravenous dexmedetomidine and local lignocaine infiltration to attenuate the haemodynamic response to skull pin head holder application during craniotomy. Indian J Anaesth 59: 785-788.

18. Kondavagilu SR, Pujari VS, Bevinguddaiah Y (2017) Low dose dexmedetomidine attenuates hemodynamic response to skull pin holder application. Anesth Essays Res 11: 57-61.

19. Nanjundaswamy NH, Marulasiddappa V (2017) Attenuation of hemodynamic response to skull pin head holder insertion: Intravenous clonidine versus intravenous lignocaine infusion. Anesth Essays Res 11: 129-133.