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RESEARCH ARTICLE

Headache Management in Neurosurgical Postoperative Patients

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ABSTRACT

Introduction: Headache in neurosurgical patients is an important clinical problem that has been receiving an increasing amount of attention. However, only a few studies have described cases of headache following craniotomy, and even fewer have proposed pain management for this pathology. In contrast, general postoperative pain has been extensively studied, and there are thus many guidelines to treat such pain. Here we propose a regimen that includes the use of analgesics based on postoperative pain guidelines.

Material and Methods: A randomized prospective study was performed on all neurosurgical patients who had underwent craniotomy at the National Institute of Neurology and Neurosurgery between September 2016 and September 2017. The subjects were subdivided into control and experimental groups. Each group comprised 50 patients. Analgesic management in the experimental group was based on multimodal analgesia.

Results and Discussion: There was a significant difference in the Analogue Visual Scale scores between the control and experimental groups, both on the last hospitalization day ($p = 0.000$) and at the 6-month follow-up ($p = 0.002$). There was thus a significant amelioration of pain among patients in the experimental group when compared to those in the control group.

Adequate preoperative and follow up pain management is of most importance for patient care and outcome.Our findings indicate that there was a decrease in pain following multimodal analgesia in post-craniotomy patients

Conclusion: Based on the results obtained in this study and the previously reported evidence, we suggest that postoperative management of acute and persistent headache in patients who undergo craniotomy should comprise multimodal analgesia.

Keywords: postoperative pain management, headache, craniotomy, opioids, persistent pain, acute pain, multimodal analgesia

1. Introduction

Headache in neurosurgical patients is an important clinical problem that has received increasing attention due to its high frequency. In fact, 30% of patients who undergo craniotomy have acute post-craniotomy headache (PCH), and 28% have chronic PCH (1). However, only a few studies have described cases of headache following craniotomy, and even fewer have proposed pain management guidelines for this pathology (2). Moreover, though headache attributed to craniotomy is described in the International Headache Classification (ICHD-3), the ICHD-3 neither provides details concerning the type of craniotomy performed nor does it provide management guidelines (3). The ICHD-3 does, however, subcategorize the condition as either acute or persistent. The former is described as a headache caused by surgical craniotomy lasting less than 3 months. Persistent headache lasts longer than 3 months and develops within 7 days of craniotomy, the subsequent regaining of consciousness, or the discontinuation of pain medication (4).

In order to address the above-described gap in the literature and to elucidate the pathology of post-craniotomy pain, it is necessary to identify structures involved in neurosurgical approaches that are sensitive to pain (5). Soft tissues – as opposed to brain tissues - are likely to be the cause of pain following neurosurgery. Of particular importance in this regard are the pericranial muscles, temporal and occipital pericranium, and dural vessels. Suboccipital and subtemporal neurosurgical approaches lead to the highest incidence of pain, likely due to the involvement of muscle tissues during surgery (2).

General postoperative pain has been extensively studied, and there are thus many guidelines to treat such pain. More than 80% of postoperative patients experience pain regardless of the procedure. Of these patients, 75% classify the pain as moderate to severe (6). Such acute pain can cause central sensitization, which further leads to chronic pain (7-9). Postoperative acute pain management is thus paramount due to the high risk of central sensitization (9,10).

Regional, opioid, and multimodal analgesia have been proven to reduce postoperative pain (11), and opioid administration has been demonstrated to directly alleviate the severity of postoperative pain (12). However, many physicians are hesitant to prescribe opioids because of their side effects, the most common of which are constipation and nausea (13). Accounting for such possibilities, current postoperative pain management guidelines recommend that treatment of pain must be adjusted according to the progress of improvement and the presence of side effects (7,14,15). The Analogue Visual Scale (AVS) used to assess pain includes the following scores: mild pain (AVS 1-4), nonsteroidal anti-inflammatory drugs (NSAIDs) + paracetamol; moderate pain (AVS 5-7), NSAIDS + acetaminophen + patient-controlled weak opioids; severe pain (AVS 8-10), NSAIDS + acetaminophen + potent opioids (with appropriate monitoring) (6,16,17). In case of opioid-induced side effects, the administration of either gabapentin or pregabalin is recommended; they increase the effects of opioids and thus allow for treatment with lower doses while diminishing their side effects (18,19). However, in all cases of uncontrolled, untreatable, or refractory pain, consultation with a pain expert is recommended (20,21,22).

Despite the presence of such well-defined procedures addressing general postoperative pain and the relative increase in the number of studies of postoperative headache, there is a dearth of reports on headache management guidelines. The high prevalence of acute and persistent pain among postoperative neurosurgical patients underscores the need for specific guidelines addressing this type of postoperative pain.

Transoperative pain management in neurosurgical patients has been widely studied by neuroanesthesiologists. However, it is usually managed by neurosurgeons who do not have specific postoperative pain management guidelines. In the present study, we sought to prove that the use of multimodal analgesia in post-craniotomy patients would ameliorate the high prevalence of post-craniotomy headache among neurosurgical patients. Here we propose a regimen that includes the use of analgesics based on multimodal analgesia as described in postoperative pain guidelines.

2.Materials and Methods

A randomized prospective study of all neurosurgical patients who had undergone craniotomy at the National Institute of Neurology and Neurosurgery between September 2016 and September 2017 was performed. During this period of time, 1050 patients were submitted to a neurosurgical procedure. Our sample group of patients were divided into three groups based on the neurosurgical approach: supratentorial, infratentorial, and transsphenoidal Each group comprised 100 patients (300 patients in total, 95% confidence level, 4.9% margin of error). The patients were further subdivided into control and

experimental groups, each of which contained 50 patients.

Analgesic management in the experimental group was based on multimodal analgesia, as described below. We used NSAIDs and paracetamol for acute mild pain, NSAIDS, acetaminophen, and patient-controlled weak opioids were used for moderate pain, and NSAIDS, acetaminophen, and potent opioids were used for severe pain. When there were side effects associated with opioids, antineuritics were added and opioid dosage was diminished.

All patients included in this study had a 3 and 6 month follow up.

All patients in the experimental group were managed with paracetamol and NSAIDs during the 3 months of follow-up in case of pain. All pain management was based on the intensity of pain, no medication was used before the pain evaluation. No opioid or muscle relaxants were used during this follow-up period.

In the control group, pain was managed by the patient's attending neurosurgeon. In contrast, in the experimental group, pain management was performed based on the international postoperative guidelines, which are based on the degree of pain, as evaluated using the AVS.

Statistical analysis of data from all patients was performed using IBM SPSS Statistics (version 22). The variables studied included age, sex, comorbidities, neurosurgical approach, and pain at the following time points: before the operation, 1 day following the procedure, last hospitalization day, 3-month follow-up, and 6-month follow-up. Analysis of variance, Chi-square, and Chi-square automatic interaction detector statistical analyses were performed.

Patients who refused to participate in the study, those for whom the AVS could not be administered because of the inability to understand or answer the question due to the neurological pathology, those who displayed contraindications for multimodal analgesia, and those who did not attend the 3- and/or 6-month follow-up visits were excluded from this study.

In this study, there was no intervention in the neurosurgical management of the patients. All patients received a detailed explanation of the purpose and procedures used in the study, and informed consent was obtained from all patients who participated in this study. All procedures conformed to the Declaration of Helsinki.

3.Results

All patients were adults submitted to craniotomy with different diagnosis, aged 16-91 years (mean, 45 years). (Figure 1) Of all patients, 52% were female and 47% were male. The pathological history of the patient had no effect on the presentation or management of pain. Of the 300 patients, three exhibited nausea and one presented with nausea and vomiting following opioid administration. All side effects ceased with the lowering of opioid dosage and the administration of gabapentin. (Table 1).

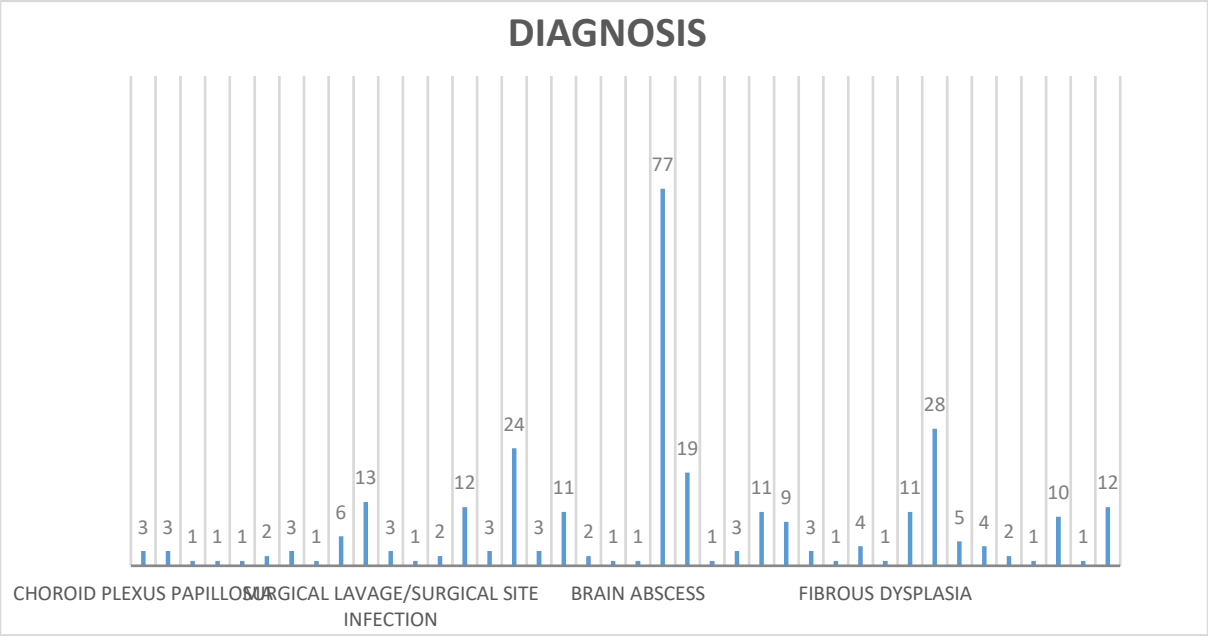

Figure 1: Patients were submitted to craniotomy for many different diagnosis, the most frequent diagnosis was pituitary adenoma as it represents 77% of patients in the transsphendoidal group.

All patients were treated with at least one medication for acute pain following craniotomy, based on pain intensity measured by VAS.

75% of patients on the 3 month follow up and 95% in the 6 month follow up needed no pain management. There were no statistically significant differences between the control and experimental groups in pre operational treatment, preoperational headache, first postoperative day headache, and 3 month follow up.(Table 1)

	No Cases =300	*Percentage*	*P Value*
Age	Median=45 (16- 45)	-	0.97
Gender	F= 156 M= 144	F=52% M=47%	0.36
Comorbidity	SAH= 37 DM= 15 Hipotiroidism=10 None=221	SAH= 12.3% DM= 5% Hipotiroidism=3.3% None=73.2%	0.62
Pre-operational Treatment	Ibuprofen= 8 Ketorolaco = 9 NSAID= 36 None= 209	Ibuprofen= 2.6% Ketorolaco= 3% NSAID= 8.9% None=69.2%	0.45
Pre-operational headache (VAS)	Median= 1.8 (0-10) VAS 0 = 146 VAS 4= 29 VAS 5= 14	VAS 0= 64.9% VAS 4= 9.6% VAS 5= 4.6%	0.85
First Post-operative day headache (VAS)	Median= 1.03(0-8) VAS 0 = 206 VAS 2 =45 VAS 4=19	VAS 0 = 68.7 % VAS 2 = 15% VAS 4= 6.3%	0.82
Last Hospitalization day headache(VAS)	Median = 0.34 (0-5) VAS 0 = 263 VAS 2= 27 VAS 3= 4	VAS 0 = 87.1% VAS 2= 8.9 % VAS 3= 1.3%	0.000
Pharmacological treatment complications	None= 296 Nausea= 3 Nausea and vomit= 1	None= 98% Nausea= 1% Nausea and vomit= 0.3%	0.51
3-Month follow-up	Median=0.81 VAS 0 =221 VAS 2 = 31 VAS 4 = 27	VAS 0 = 73.2% VAS 2 = 10.3% VAS 4 = 8.9%	0.87
6- Month follow-up	Median= 0.12 VAS 0= 282 VAS 2= 17 VAS 3=1	VAS 0= 93.4% VAS 2= 5.6% VAS 3=0.3%	0.002

Table 1: This table shows all percentage and number of cases , as well as the fact that there were no statistically significant differences between control and experimental group in pre operational treatment, preoperational headache, first postoperative day headache, and 3 month follow up.

On the last postoperative hospitalization day, there was a significant statistical difference in the AVS score between the control and experimental groups ($p = 0.000$) (Figure 1). At this time point, there were patients with an AVS score >3. The statistically significant difference in AVS score between the two groups was also observed at the 6-month follow-up ($p = 0.002$) Figure 2. This indicates that there was a significant amelioration of pain in patients in the experimental group when compared to those in the control group.

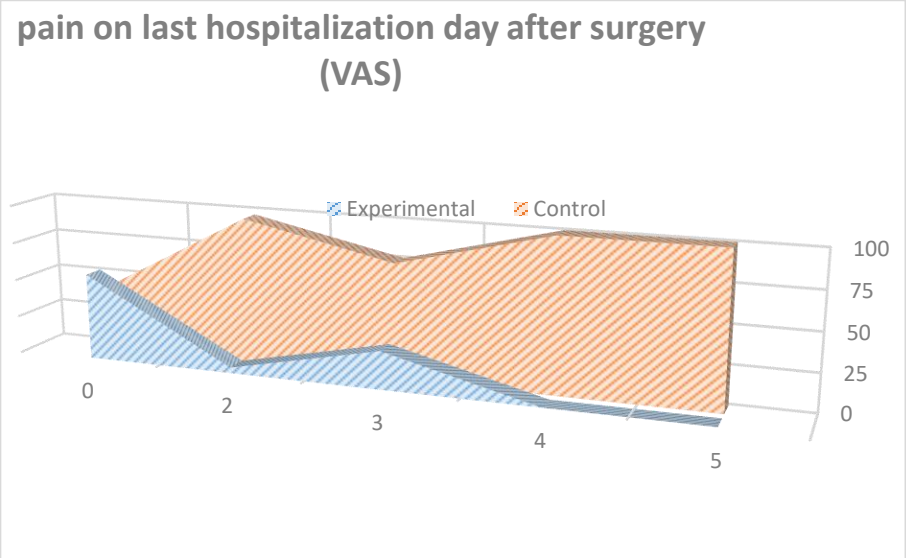

Figure 2: Last hospitalization day had a significant statistical difference between the control and experimental groups P= 0.000.

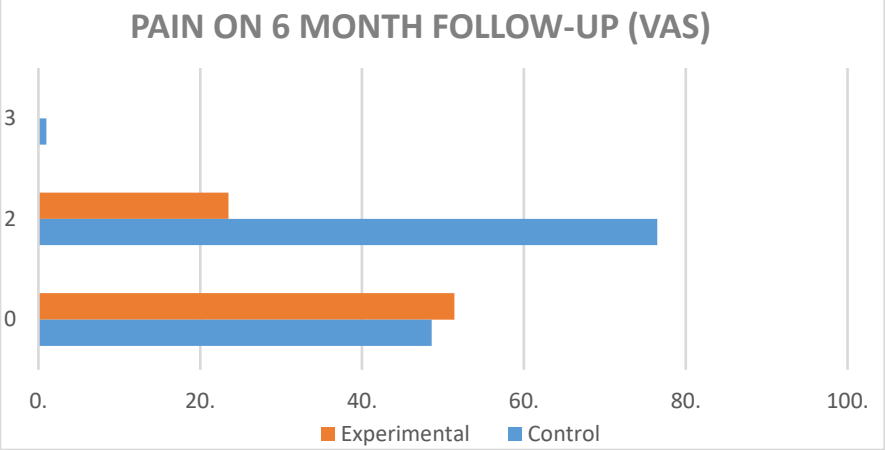

Figure 3: On the 6 month follow-up there was a significant difference between the control and the experimental group with better pain outcome in the experimental group (P= 0.002)

The difference in AVS score between the control and experiment groups was not significant 1 day following the operation or at the 3-month follow up. By the latter time point, 98% of patients in the experimental group who experienced any degree of pain were not following the written instructions of pain management. These patients stated that they stopped using the medication due to the low level of pain (AVS score <3). All patients in the experimental group who followed the written instructions after the 3-month follow-up visit reported diminished pain at the 6-month follow-up visit.

Discussion

As mentioned previously acute postoperative pain is common and unrecognized in post-craniotomy patients, adequate preoperative and follow up pain management is of most importance for patient care and outcome. We have now a better understanding of the pathophysiology of acute and chronic pain and we now know a multimodal approach has the highest effectivity for reducing both pain and pharmacological side effects.

Our findings indicate that there was a decrease in pain following multimodal analgesia in post-craniotomy patients. Our study highlights the importance of headache vigilance in postoperative follow-ups. We recommend the use of pain management as described in this article for the treatment of post-craniotomy patients who have no contraindications for the use of pain medicines. We believe that neurosurgeons should devote more attention to headache management in daily practice.

Conclusion

Based on the results obtained in this study and the previously reported evidence, we suggest that

postoperative management of acute and persistent headache in neurosurgical patients should consist of multimodal analgesia that is continually adjusted based on alterations in experienced pain and side effects. We further believe that pain management would help alleviate fear of using opioids among neurological patients, who should follow the physician's instructions until the 6-month follow-up visit. This study was performed in only one center and was focused only on adult neurosurgical patients who underwent a craniotomy. It would be interesting to study analgesia in other neurosurgical areas, such as pediatric neurosurgery, spine surgery, and peripheral nerve surgery. A multi-centered high quality clinical study would be the next step in further proving the efficacy of multimodal analgesia in neurosurgical patients as well as the measurement of quality of life for the patients with persistent headache following craniotomy.

4. Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

5. Author Contributions

JLG-A is the tutor of this project. CC-M and JFZ-P performed data analysis. EB-S JRM-P and MI-A collected the data.

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7.References

1. Subbarao B.S, Blessen CE. Headache post craniotomy. Stat Pearls Publishing.2022 ;1(1): 412-434
2. Gray L.C, Matta B.F. Acute and chronic pain following craniotomy: a review. Anaesthesia .2005; 60 (1): 693-704.
3. Lutman B, Bloom J, Nussenblatt B, Romo V. A .Contemporary perspective on the management of post-craniotomy headache and pain. Curr Pain Headache Rep . 2018 ;22(10):69.
4. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. Cephalalgia .2018 ;38(1):1-211.
5. Jandial R, McCormick P, Black P. Core techniques in intraoperative neurosurgery. Elsevier/Sounders. 2011;1(1): 234-256.
6. Neria F, Ortega JL, Martinez J, Galvez R, De la Torre R, Torres LM. Evaluación mediante AEREE de guías de práctica clínica en dolor postoperatorio. Rev Esp Anestesiol Reanim . 2005 ; 52 (1):349-54.
7. Chou R, Gordon DB, de Leon-Casasola OA, Rosenberg JM, Bickler S, Brennan T, et al. Management of postoperative pain: a clinical practice guideline ; American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia Executive Committee. Journal of Pain .2016; 17(1) :131-57.
8. Haley J. E, Dickenson A.H. ,Evidence for spinal N-Methyl-D-Aspartate receptor involvement in prolonged chemical nociception in the rat. Brain Res .2016 ; 1545 (1) :58-60
9. Bourlinet E, Altier C, Hilderbrande ME, Trang T, Salter MW, Zamponi GW. Calcium permeable ion channels in pain signaling. Physiol Rev. 2014; 94(1) :81-140.
10. Woolf CJ. Central sensitization: implications for the diagnosis and treatment of pain. Pain .2011; 152(2):2-15.
11. Vadivelu N, Mistra S, Narayan D. Recent advances in postoperative pain medicine. Yale J Biol Med . 2010; 83(1) :11-25.
12. Toquero F, Zarco J. Guía de practica clínica del dolor y su tratamiento. IMC . 2004 ; 1 (1): 25-34.
13. Benyamin R, Trescot AM, Datta S, Buenaventura R, Adlaka R, Sehgal N, et al. Opioid complications and side effects, Pain Physician .2008 ; 11(1) :105-20.
14. Fernandez C.F, Gomez M.P. Dolor agudo y postoperatorio. ACED. 2011 ;1(2): 45-78.
15. Warfield C, Kahn C. H, Acute pain management. Programs in US hospitals and experiences and attitudes among US adults. Anesthesiology .1994; 83(1) :1090-4.
16. American Society of Anesthesiologists Task Force on Acute Pain Management. Practice guidelines for acute pain management in the perioperative setting: an updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management. Anesthesiology .2012; 116(3) :248-73.
17. NHS Quality Improvement Scotland, Best practice statement: postoperative pain management. 2004; 1(2): 532-6.
18. Kong VKF, Irwin MG. Gabapentin a multimodal perioperative drug. Br J Anesth .2007; 99(6) :775-86.
19. Peng PWH, Wijeysundera DN, Li CF. Use of gabapentin for perioperative pain control a meta-analysis. Pain Res Manage .2007; 12(1) :85-92.
20. Chronic Pain Medical Treatment Guidelines and Opioids Treatment Guidelines, Medical Treatment Utilization Schedule (MTUS). 2009 ;1(1):235-7.
21. Apfelbaum JL, Chen C, Mehta SS, Gan TJ. Postoperative pain experience: Results from a national survey suggest postoperative pain continues to be undermanaged. Anesth Analg . 2003; 97(12):534-40.
22. Guevara-Lopez U, Covarrubias–Gomez A, Delille-Fuentes R, Hernandez- Ortiz A, Carrillo-Esper R, Moyayo-Garcia D. Parámetros de práctica para el manejo del dolor agudo perioperatorio. Cir Ciruj .2005; 73(2) :223-32.
23. C Small, H Laycock, Acute postoperative pain management, British Journal of Surgery. 2020 ; 107(2):70-80.
24. Michael A. E. Ramsay Acute Postoperative Pain Management, Baylor University Medical Center Proceedings. 2000; 13(3) : 244-247.
25. Mitra, S., Carlyle, D., Kodumudi, G. et al. New Advances in Acute Postoperative Pain Management. Curr Pain Headache Rep .2022; 35 (2) :1-14
26. Flexman, Alana M; Ng, Julie L; Gelb, Adrian W, Acute and chronic pain following craniotomy, Current Opinion in Anaesthesiology .2010; 23(5):551-557.
27. N. Quiney, R. Cooper, M. Stoneham & F. Walt ers . Pain after craniotomy. A time for reappraisal, British Journal of Neurosurgery.1999; 10(3): 295-300
28. Lee EJ, Lee MY, Shyr MH, Cheng JT, Toung TJ, Mirski MA, et al. Adjuvant bupivacaine scalp block facilitates stabilization of hemodynamics in patients undergoing craniotomy with general

anesthesia: a preliminary report. J Clin Anesth .2006 ;18(4):490–4.
29. Mosek AC, Dodick DW, Ebersold MJ, Swanson JW. Headache after resection of acoustic neuroma. Headache . 1999; 39(2):89–94.
30. Talke PO, Gelb AW. Postcraniotomy pain remains a real headache. Eur J Anaesthesiol .2005 ; 22(2) :325–7.
31. Rocha-Filho PA. Post-craniotomy headache: a clinical view with a focus on the persistent form. Headache ;55(5):733-8
32. Dunbar PJ, Visco E, Lam AM. Craniotomy procedures are associated with less analgesic requirements than other surgical procedures. Anesth Analg .1999; 88(1):335–40.
33. Saramma PP, Mathew R. Assessment of post-operative pain and its management among patients undergoing craniotomy. Nurs J India . 2013 ; 104(3):101–3.
34. Atalano PJ, Jacobowitz O, Post KD. Prevention of headache after retrosigmoid removal of acoustic tumors. Am J Otol .1996; 17(1) :904–8.
35. Lai LT, Ortiz-Cardona JR, Bendo AA. Perioperative pain management in the neurosurgical patient. Anesthesiol Clin. 2012; 30(2) :347–67