ORIGINAL ARTICLE

Management of Chronic Subdural Hematoma: A National Survey and Literature Review

Aleksa Cenic, Mohit Bhandari, Kesava Reddy

ABSTRACT: ***Objective:*** To survey neurosurgical practices in the treatment of chronic and subacute subdural hematoma in the Canadian adult population. ***Methods:*** We developed and administered a questionnaire to Canadian Neurosurgeons with questions relating to the management of chronic and subacute subdural hematoma. Our sampling frame included all neurosurgery members of the Canadian Neurosurgical Society. ***Results:*** Of 158 questionnaires, 120 were returned (response rate = 76%). The respondents were neurosurgeons with primarily adult clinical practices (108/120). Surgeons preferred one and two burr-hole craniostomy to craniotomy or twist-drill craniostomy as the procedure of choice for initial treatment of subdural hematoma (35.5% vs 49.5% vs 4.7% vs 9.3%, respectively). Craniotomy and two burr-holes were preferred for recurrent subdural hematomas (43.3% and 35.1%, respectively). Surgeons preferred irrigation of the subdural cavity (79.6%), use of a subdural drain (80.6%), and no use of anti-convulsants or corticosteroids (82.1% and 86.6%, respectively). We identified a lack of consensus with keeping patients supine following surgery and post-operative antibiotic use. ***Conclusion:*** Our survey has identified variations in practice patterns among Canadian Neurosurgeons with respect to treatment of subacute or chronic subdural hematoma (SDH). Our findings support the need for further prospective studies and clinical trials to resolve areas of discrepancies in clinical management and hence, standardize treatment regimens.

RÉSUMÉ: Prise en charge de l'hématome sous-dural chronique: enquête nationale et revue de la littérature. ***Objectif:*** Effectuer une enquête sur le traitement neurochirurgical de l'hématome sous-dural chronique et subaigu dans la population adulte canadienne. ***Méthodes:*** Nous avons développé un questionnaire comportant des questions sur la prise en charge de l'hématome sous-dural chronique et subaigu et nous l'avons soumis aux neurochirurgiens canadiens. Notre échantillon était constitué de tous les membres de la Société canadienne de neurochirurgie. ***Résultats:*** 120 des 158 questionnaires postés ont été retournés (taux de réponse de 76%). Les répondants étaient des neurochirurgiens en pratique clinique adulte surtout (108/120). Les chirurgiens préféraient la craniostomie à un et à deux trous de trépan plutôt que la craniotomie ou la craniostomie par foret hélicoïdal pour le traitement initial de l'hématome sous-dural (35,5% ; 49,5% ; 4,7% ; 9,3% respectivement). La craniotomie et la craniostomie à deux trous de fraise étaient les techniques privilégiées pour traiter les récidives d'hématomes sous-duraux (43,3% et 35,1% respectivement). Les chirurgiens préféraient l'irrigation de la cavité sous-durale (79,6%), la mise en place d'un drain sous-dural (80,6%) sans administration d'anti-convulsivants ou de corticostéroïdes (82,1% et 86,6% respectivement). Nous avons constaté une absence de consensus en ce qui concerne la position du patient en décubitus dorsal après la chirurgie et l'utilisation d'antibiotiques dans les suites postopératoires. ***Conclusion:*** Notre enquête a identifié des différences dans le traitement de l'hématome sous-dural sub-aigu ou chronique par les neurochirurgiens canadiens. Ces constatations soulignent le besoin d'études prospectives et d'essais thérapeutiques pour résoudre ces différences dans la prise en charge et donc pour standardiser la prise en charge de ces affections.

Can. J. Neurol. Sci. 2005; 32: 501-506

Chronic subdural hematoma (SDH) in the elderly population is a common problem encountered in neurosurgical practice. The incidence of chronic SDH has been reported as 1.7 per 100,000/year.[1] Thus, in Canada (population = 32 million), we can expect approximately 550 individuals with chronic SDHs per year. The peak incidence occurs in the sixth and seventh decades to 7.4 per 100,000 in the 70-79 age group.[1] With a greater proportion of elderly individuals in Canada over the next decade, the incidence of chronic SDH will further increase.

Chronic SDH is typically defined as a hematoma with a duration greater than three weeks.[2,3] This differs from subacute SDH which is characterized by a shorter duration (three days to three weeks post initiating event).[2,3]

While most surgeons agree that surgical evacuation of chronic SDH is a key management principle in symptomatic patients, there remains a lack of consensus in the surgical technique, peri-operative management, and approach to recurrences as shown by Weigel et al.[4] in their recent systematic-

From the Division of Neurosurgery (AC, KR); Division of Orthopedics (MB) McMaster University, Hamilton, Ontario, Canada.

RECEIVED FEBRUARY 23, 2005. ACCEPTED IN FINAL FORM JUNE 20, 2005.

Reprint requests to: Kesava Reddy, 66 Charlton Avenue West, Hamilton, Ontario, L8P 2C1, Canada

based review of the literature. The most commonly used surgical approaches include: twist-drill craniostomy, one or two burr-holes craniectomy, and craniotomy.[4] As shown by Weigel et al[4] and various case studies,[5-10] the adjuvant pre- and post-operative management variations include: the use of subdural drains, irrigating the subdural cavity, pre- and post-operative antibiotics, prophylactic use of anti-convulsants or dexameth-asone use in non-surgically managed patients.

Current evidence in the management of chronic SDH is limited. There are no well-designed randomized trials and only six prospective studies evaluating alternative management strategies.[4] The majority of the evidence is limited to case series which are limited by inherent bias in their design.[4] In the absence of high quality evidence, surgeons rely on clinical expertise and experience to manage their patients.

Given the importance of identifying optimal strategies to manage SDH, we conducted a national survey of members of the Canadian Neurosurgical Society to ascertain neurosurgical practices in the treatment of chronic or subacute SDHs in the Canadian adult population. We further aimed to provide data to focus future clinical research to resolve existing discrepancies in clinical management.

METHODS

Survey Development

The survey questions were sub-divided into six areas: 1) surgeon's predominant practice (adult vs. pediatrics), 2) surgical procedure of choice (initial and recurrent presentation), 3) adjuvant surgical management, 4) location of surgical treatment, 5) pre- and post-operative care, and 6) patient characteristics influencing management. The questionnaire was formatted as a series of "circle" one of the options, "yes/no" and one word answer questions. The survey was sent out as a pilot study to five neurosurgeons at our institution in order to test for clarity and appropriate scope of questions. As to the questions regarding surgical procedure of choice, they were designed to determine whether twist-drill, one burr-hole, two burr-holes, craniotomy, subdural-peritoneal shunt or "other" were preferred in the initial and recurrent management of SDH. The next set of questions addressed the following: irrigation of the subdural cavity, use of subdural drain, type of drain and the amount of suction on drain. In order to determine where in the hospital surgery is performed, the following options were provided: Operating Room (OR), Intensive Care Unit (ICU), Stepdown Unit, Ward, or "Other". The questions regarding pre- and post-operative care were included to address the following issues: keeping patients "flat" post-operative and for how long, use of pre- and post-operative antibiotics and type, and the use of corticosteroids and anti-convulsants. Remaining questions were addressed to determine whether patient management would change with respect to patient's age and clinical condition. Finally, space was left for respondent's comments at the bottom of the questionnaire. For our French counterparts in Quebec, the survey was translated into French. The final survey consisted of six major themes, 12 questions and required approximately two minutes to complete.

Survey Administration

We administered the survey by fax to all the Neurosurgeons in Canada. Neurosurgeons were identified through the Canadian Neurosurgical Society Member Directory and various Canadian Neurosurgery Department Internet Websites. When fax numbers were not reported for a neurosurgeon, we contacted the office to

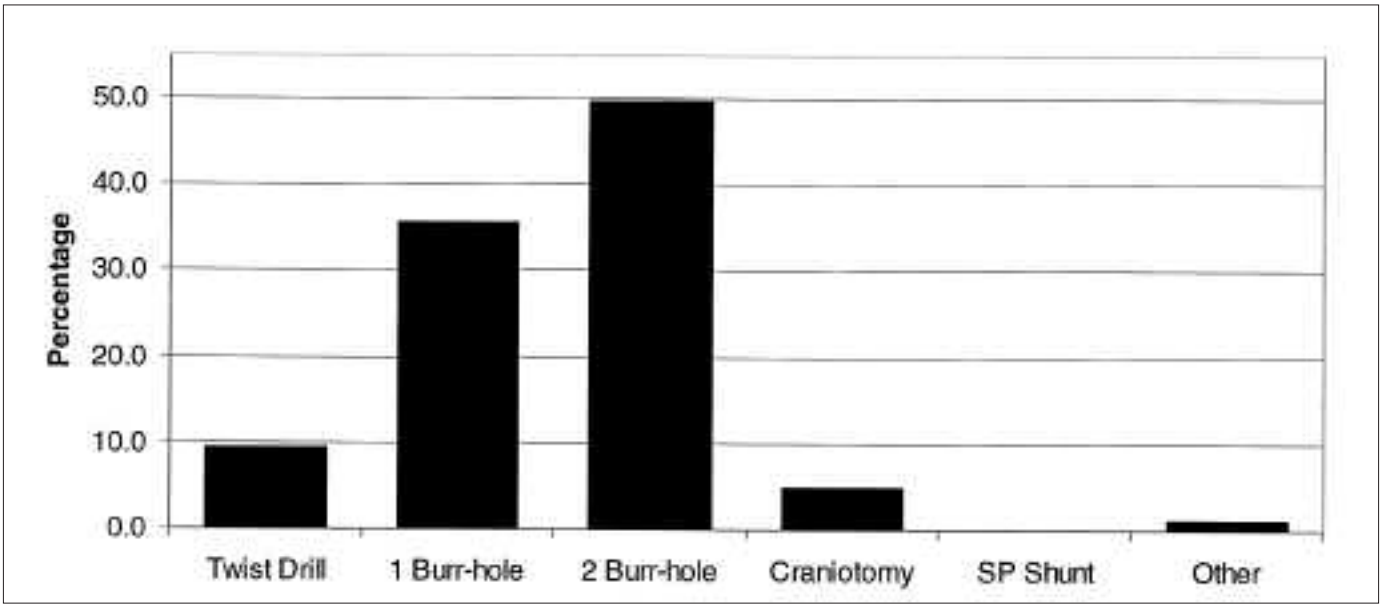

Figure 1a: *Surgical procedure of choice for initial subacute or chronic SDH. Statistically significant difference between response rates for Twist Drill and 1-Burr-Hole (P<0.01). Not statistically significant difference between 1-Burr-Hole and 2-Burr-Holes (P=0.09). SP Shunt, Subdural Peritoneal Shunt.*

https://doi.org/10.1017/S0317167100004510 Published online by Cambridge University Press

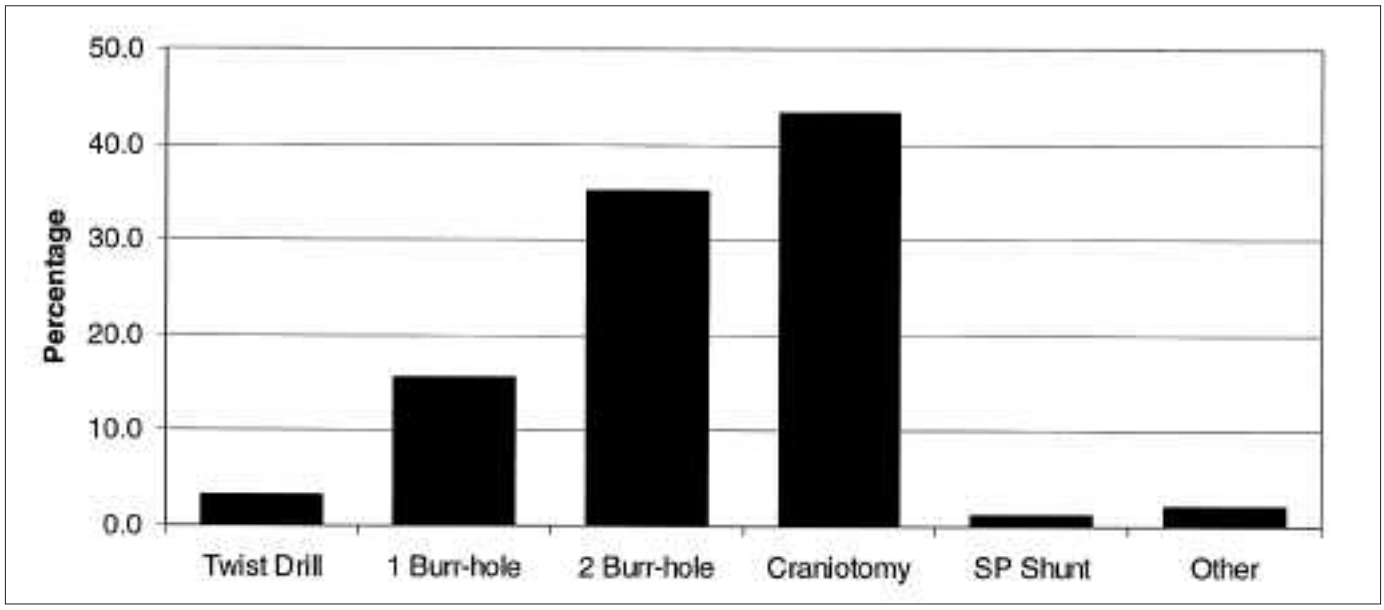

Figure 1b: *Surgical procedure of choice for recurrent subacute or chronic SDH. Statistically significant difference between 1-Burr-Hole and 2-Burr-Holes (P<0.01). No statistically significant difference between 2-Burr-Hole and Craniotomy (P=0.4). SP Shunt, Subdural Peritoneal Shunt.*

obtain a current number for survey administration. A cover letter faxed with each survey outlined the importance of the study as well as the confidentiality of the responses. Our decision to use fax administration was based upon previous literature supporting its use in surveys.[11]

At six weeks, we re-faxed the survey to surgeon non-responders.

Data Analysis

We entered data into MS-Excel database. We summarized findings with descriptive statistics (proportions, means). Differences in response rates between various categories were evaluated using Chi-square statistics. Statistical significance was considered as $P < 0.05$.

Results

Of 158 surveys administered, 120 were returned (76% response rate). The predominant Neurosurgical practice was as follows: surgeons practice adult (n=106), pediatric (n=12) or both (n=2). Our analysis focused upon those 108 surgeons who treat adult neurosurgical patients. Pediatric neurosurgeons' responses were not analyzed due to the very small number (n=12), and the paucity of available current literature addressing this topic in the pediatric population.

Surgical Procedure of Choice

Initial surgical management of SDH favored two burr-holes (49.5%) (Figure 1a). Surgeons were 10.5 times more likely to prefer two burr-holes than craniotomy for acute management of SDH (P<0.05). However, craniotomy was the preferred procedure in recurrent SDHs (Figure 1b). Surgeons were 1.3 times more like to use a craniotomy over two burr-holes in the management of recurrent SDHs although this did not reach statistical significance over two burr-hole techniques (P=0.4).

Adjuvant Surgical Management

Irrigation of the subdural cavity was performed by 79.6% (n=86) of respondents. Most surgeons (80.6%, n=87) also agreed in placing a drainage system in the subdural space. The most common drain used was a Jackson Pratt (78.6%, n=66).

Pre- and Post-Operative Care

Corticosteroids were not used by 86.7% (n=91) of surgeons as part of their clinical management of this condition. Similarly, surgeons avoided the use of anti-convulsants (82.1%, n=87) in both subacute or chronic SDHs. Figure 2 reveals the response rate for the use of antibiotics pre- and post-operatively. Consensus was achieved in the use of peri-operative antibiotics. However, surgeons were significantly more likely to prefer pre-operative antibiotics when compared to the use of post-operative antibiotics (70.1% vs 35.7%, P<0.05, respectively). In those neurosurgeons who prescribed antibiotics, the most commonly used is a first generation cephalosporin (e.g., Ancef) (99%, n=74).

Over half the surgeons (54.6%, n=59) preferred keeping patients flat post-operatively. Of these respondents, 87.9% (n=51) allowed the use of a pillow. The duration of bedrest varied (Figure 3) with the majority of surgeons preferring 24 hours bedrest (52.5%, n=31).

Hospital Location of Surgical Management

Neurosurgeons performed 85.1% (n=97) of their surgical procedures in the operating room. However, surgeons also

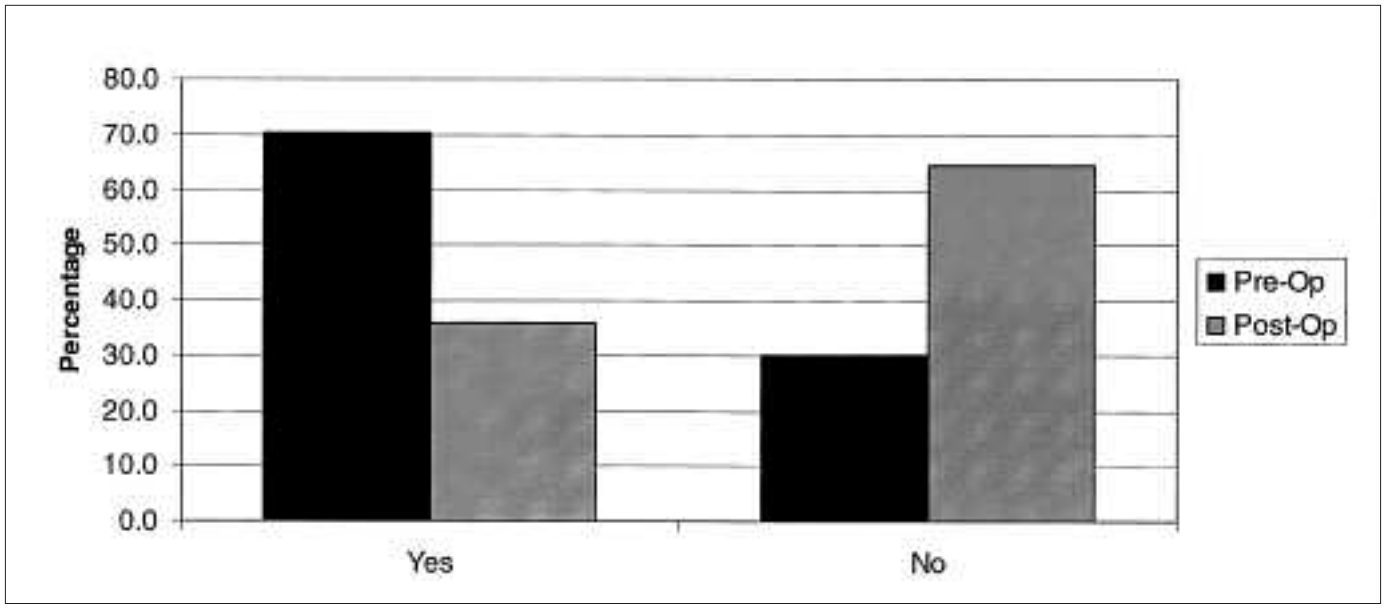

Figure 2: *Use of Antibiotics Pre- and Post-Operatively. Statistically significant difference in response rates within the Pre-Op and Post-Op groups (P<0.01).*

performed procedures in either the Intensive Care Unit (n=5), Stepdown Unit (n=6), or Ward (n=5). Only 1% (n=1) of procedures are done in the Emergency Room.

Patient Characteristics Influencing Clinical Management

Surgeons management preferences (69.8%, n=74) did not change with patient age. However, two thirds of surgeons (66.4%, n=71) believed the clinical status of their patient was an important predictor of management preference.

Discussion

Our survey of Canadian neurosurgeons identified the following: 1) surgeons preferprocedures using one and two burr-holes significantly over alternative methods in the initial management of chronic or subacute SDH; 2) both craniotomy and two burr-holes were preferred methods in recurrent SDHs; 3) drainage systems were commonly used following surgery, and 4) corticosteroid and anticonvulsant use was uncommon in SDH.

Although there are no trials comparing one- and two-burr-holes, a recent systematic review of the literature[4] reported that twist-drill and burr-hole craniostomy with drainage appear to be the most effective treatments when considering morbidity, mortality, and recurrence rates. In this review of 48 studies,[4] craniotomy was found to have morbidity of 12.3% (range 0-25%), mortality of 4.6% (range 0-11%), and recurrence rate of 10.8% (range 0-44%). In comparison, twist-drill craniostomy and burr-hole craniostomy were found to have a morbidity of 3.0% (range 0-7.6%) and 3.8% (range 0-9%), mortality of 2.9% (range 0-7.9%) and 2.7% (range 0-32%), and recurrence rate of 33.0% (range 3-76%) and 12.1% (range 0-28.8%), respectively.[4] Weigel et al[4] report that craniotomy should be considered a second tier treatment even for recurrences due to the high morbidity and mortality rates when compared to twist drill and burr-hole. Although, only a single respondent chose subdural-peritoneal shunt for recurrent SDHs in our survey, Probst[12] reported it to be an effective technique for recurrent chronic SDH that is refractory to regular treatment, in 14 patients, with respect to no recurrence and quick neurological improvement. In a case report, Misra et al[13] reported similar effectiveness with respect to clinical and radiological improvement in a single patient with bilateral chronic SDHs treated with subdural-peritoneal shunt.

Greater than 79% of neurosurgeons in our survey irrigated the subdural cavity and used a subdural drain. With regards to irrigating the subdural cavity, Okada et al[14] found a recurrence rate to be five times more significant in the burr-hole irrigation group versus the burr-hole drainage group (25% vs 5%, respectively). Kuroki et al[15] also found a greater than five-fold increase in recurrence rate when irrigation with drainage was used in comparison to drainage alone (11.1% vs 1.8%, respectively). Some studies support the use of a closed-system drainage in that they have been shown to decrease the recurrence rate in comparison to not using one.[16,17] In a case series of 21 patients, Markwalder et al.[16] showed a progressive clinical improvement when a drain was used in comparison to not using one. In a prospective study of 38 patients, Wakai et al[17] showed a 33% recurrence rate in their non-drain group versus 5% in the drain group.

We identified a lack of consensus on keeping patients flat post-operatively. Perhaps this disagreement is consistent with evidence from a randomized trial by Nakajima et al[7] that reported non-significant difference in recurrence rates with post-operative recumbancy.

While the majority of the procedures were performed in the operating room, 16 surgeons also performed them in other locations. This finding likely reflects the perceptions that such procedures (i.e., twist-drill craniostomy) can be safely performed

https://doi.org/10.1017/S0317167100004510 Published online by Cambridge University Press

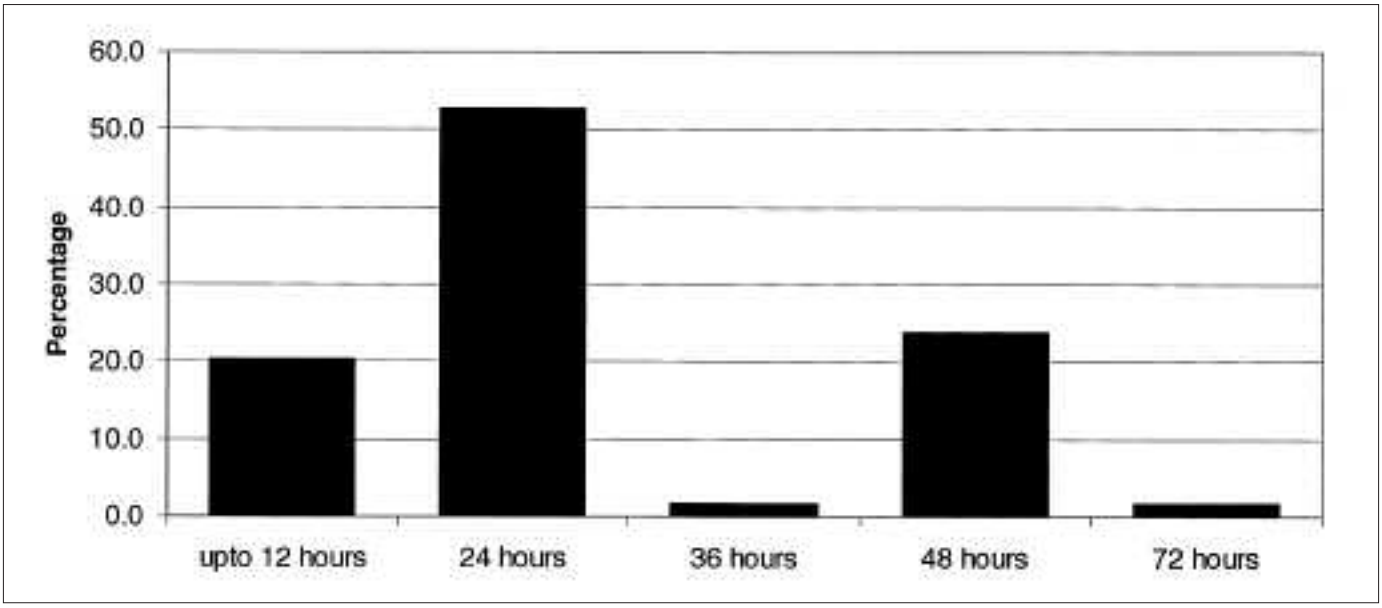

Figure 3: *Duration of keeping patients FLAT post-operatively. Statistically significant difference between "24 hours" and both "up to 12 hours" (P<0.01) and "48 hours" (P<0.05).*

in the intensive care unit, surgical step down ward, or even the emergency room when indicated, for healthy patients not requiring close intra-operative monitoring, or for emergent surgical management when operating room facilities are not immediately available.

Although not specific to either adjuvant surgical or non-surgical treatment, our survey found that surgeons in general did not use corticosteroids in their clinical management of SDH. The evidence in favor of corticosteroids is largely based upon case reports suggesting a benefit in the non-surgical management of chronic SDH.[5,10] In a case report (n=2), Decaux et al[5] showed successful recovery of two patients treated with steroids. Rudiger et al[10] also showed improved neurological outcome with dexamethasone therapy in a single patient with bi-lateral chronic SDHs. Also from our survey, majority of surgeons do not prescribe anti-convulsants in their management of SDH. Several investigators have reported that post-operative seizures occur in 3 - 32% of patients with chronic SDH.[6,8,9,18,19] The largest rate of post-operative seizures (32%) being found in a retrospective study of 50 patients with SDH.[19] The smallest rate of 3% derived from two retrospective studies in which two of 568 and four of 1439 patients not given anti-convulsants. Although these retrospective studies suggest that the routine use of post-operative anti-convulsants may be justified, further prospective studies are required to clarify this issue.

Antibiotics were routinely prescribed by surgeons pre-operatively by the majority, however post-operatively, only approximately one third prescribed antibiotics. In a large retrospective study (n=376 patients) analyzing the complications of burr-hole craniostomy and closed-system drainage for chronic subdural hematomas, Rohde et al[18] reported that subdural empyema occurred in 2.1% of post-operative patients who were given pre-operative antibiotics. Currently, there are no prospective controlled studies comparing the incidence of post-operative infections with and without antibiotic use in the treatment of SDHs.

The majority of surgeons would not alter management of SDH based upon their patient's age, but would change their management based on their patient's clinical condition. With regards to age, one might expect surgeons not to change their management since chronic SDH is generally a condition of the elderly, rather than the young. However, in the elderly with increasing probability of co-morbidities and since the key factor in surgical management is fitness to undergo surgery, one may assume a more conservative non-surgical approach. Contrary to this assumption, in a retrospective study comparing young (age < 40 years; n=24) and elderly patients (> 75 years; n=51) with chronic SDH, Liliang et al[20] showed no statistically significant difference in surgical complication rates between the two groups although the elderly group had presented with greater frequency of neurological deficits and larger hematomas.

As with any such survey investigating the practice patterns for a common neurosurgical problem, one must consider the effect of non-responder bias. It may be possible that non-respondents have different treatment strategies than those who did respond. However, we feel that our relatively high response rate (76%) may have limited this effect. Although it is estimated that there are approximately 180 neurosurgeons in Canada, we non-selectively only sent out our survey to 158. Our number compromised most practicing neurosurgeons (i.e., not retired, and affiliated with a tertiary or secondary neurosurgical care institution) in Canada. Our survey may not be generalizable to other settings and populations.

Although not addressed in this survey, two other issues that also vary in the management of chronic and subacute SDH should be considered in future studies. The first issue being

whether the surgical procedures are performed under general anesthesia or local anesthetic with neuroleptic anesthesia. The second issue is the effectiveness of performing a partial membranectomy with a craniectomy.[21]

Our survey has identified variations in practice patterns among Canadian neurosurgeons with respect to treatment of subacute or chronic SDH. Our findings support the need for higher quality prospective studies and clinical trials to resolve areas of discrepancies in clinical management and hence, verify current treatment regimens.

Acknowledgements

The authors would like to thank Dr. Farrokhyar Forough for her advice on the statistical analysis of the data.

Disclaimer

Dr. Bhandari is funded, in part, by a Canada Research Chair in Musculoskeletal Trauma and Surgical Outcomes (Canadian Institutes of Health Research).

References

1. Fogelholm R, Heiskanen O, Waltimo O. Chronic subdural hematoma in adults. Influence of patient's age on symptoms, signs, and thickness of hematoma. J Neurosurg 1975; 42:43-46.
2. Kostanian V, Choi JC, Liker MA, Go JL, Zee CS. Computed tomographic characteristics of chronic subdural hematomas. Neurosurg Clin N Am 2000; 11:479-489.
3. Prabhu SS, Zauner A, Bullock MR. Chronic subdural hematoma. In: Winn HR (Ed): Youmans Neurological Surgery. Philadelphia: Elsevier, 2003: 5170-5171.
4. Weigel R, Schmiedek P, Krauss JK. Outcome of contemporary surgery for chronic subdural haematoma: evidence based review. J Neurol Neurosurg Psychiatry 2003; 74:937-943.
5. Decaux O, Cador B, Dufour T, et al. Nonsurgical treatment of chronic subdural hematoma with steroids: two case reports [in French]. Rev Med Interne 2002; 23:788-791.
6. Kotwica Z, Brzeinski J. Epilepsy in chronic subdural haematoma. Acta Neurochir (Wien) 1991; 113:118-120.
7. Nakajima H, Yasui T, Nishikawa M, Kishi H, Kan M. The role of postoperative patient posture in the recurrence of chronic subdural hematoma: a prospective randomized trial. Surg Neurol 2002; 58:385-387.
8. Ohno K, Maehara T, Ichimura K, et al. Low incidence of seizures in patients with chronic subdural haematoma. J Neurol Neurosurg Psychiatry 1993; 56:1231-1233.
9. Rubin G, Rappaport ZH. Epilepsy in chronic subdural haematoma. Acta Neurochir (Wien) 1993; 123:39-42.
10. Rudiger A, Ronsdorf A, Merlo A, Zimmerli W. Dexamethasone treatment of a patient with large bilateral chronic subdural haematomata. Swiss Med Wkly 2001; 30;131:387.
11. Lensing SY, Gillaspy SR, Simpson PM, Jones SM, James JM. Encouraging physicians to respond to surveys through the use of fax technology. Eval Health Prof 2000; 23:349-360.
12. Probst C. Peritoneal drainage of chronic subdural hematomas in older patients. J Neurosurg 1988; 68:908-911.
13. Misra M, Salazar JL, Bloom DM. Subdural-peritoneal shunt: treatment for bilateral chronic subdural hematoma. Surg Neurol 1996; 46(4):378-383.
14. Okada Y, Akai T, Okamoto K, et al. A comparative study of the treatment of chronic subdural hematoma--burr-hole drainage versus burr-hole irrigation. Surg Neurol 2002; 57:405-409.
15. Kuroki T, Katsume M, Harada N, et al. Strict closed-system drainage for treating chronic subdural haematoma. Acta Neurochir (Wien) 2001; 43:1041-1044.
16. Markwalder TM, Seiler RW. Chronic subdural hematomas: to drain or not to drain? Neurosurgery 1985; 16:185-188.
17. Wakai S, Hashimoto K, Watanabe N, et al. Efficacy of closed-system drainage in treating chronic subdural hematoma: a prospective comparative study. Neurosurgery 1990; 26:771-773.
18. Rohde V, Graf G, Hassler W. Complications of burr-hole craniostomy and closed-system drainage for chronic subdural hematomas: a retrospective analysis of 376 patients. Neurosurg Rev 2002; 25:89-94.
19. Sabo RA, Hanigan WC, Aldag JC. Chronic subdural hematomas and seizures: the role of prophylactic anticonvulsive medication. Surg Neurol 1995; 43:579-582.
20. Liliang PC, Tsai YD, Liang CL, Lee TC, Chen HJ. Chronic subdural haematoma in young and extremely aged adults: a comparative study of two age groups. Injury 2002; 3:345-348.
21. Lee JY, Ebel H, Ernestus RI, Klug N. Various surgical treatments of chronic subdural hematoma and outcome in 172 patients: is membranectomy necessary? Surg Neurol 2004; 61:523-527.