

Introduction

Cerebral vasospasm following aneurysmal subarachnoid haemorrhage is a major cause of mortality and morbidity. The optimal management of vasospasm remains elusive. In this regard, we undertook a prospective, RCT to evaluate the effectiveness of lumbar cerebrospinal fluid (CSF) drainage for prevention of cerebral vasospasm and its sequelae.

Methods

Patients with aneurysmal SAH who met the inclusion criteria were randomized into two groups –group I(30 patients) underwent lumbar CSF rainage, while group II(30 patients) did not. All patients underwent aneurysmal clipping. Both the groups received standard reatment except for lumbar CSF drainage. The outcome was measured in terms of - 1) Clinically evident vasospasm; 2) Vasospasm-related cerebral infarction; 3) Condition at discharge; 4) GOS at 1 & 3 months follow-up.

Results

Lumbar cerebrospinal fluid (CSF) drainage conferred a statistically significant benefit reducing the incidence of clinical vasospasm from 63% (in non-LCSFD group) to 30% (in LCSFD group) (p value =0.01) and incidence of vasospasm related cerebral infarction from 53% (in non- LCSFD group) to 20%(in LCSFD group) (p value = 0.007). Incidence of vasospasm was quantitatively lower in lumbar CSF drain group across all Hunt & Hess grades, however it was statistically significant in SAH grade III(p value = 0.008). Mean duration of hospital stay was slightly lower in LCSFD group compared to non- LCSFD group, however it did not reach statistical significance. A higher Glasgow Outcome Score (GOS) was observed in LCSFD group at 1 and 3-months follow-up as compared to non- LCSFD group.

Conclusions

Drainage of CSF through a lumbar drain following aneurysmal SAH caused a statistically significant reduction in the incidence of clinical and radiological vasospasm and its sequelae. It also shortens the overall duration of hospital stay and improves the outcome as evidenced by a better GOS score at 1 and 3-months follow-up.

Learning Objectives

To assess the efficacy of spinal CSF drainage for prevention of vasospasm in aneurysmal SAH

References

Awad IA, Carter LP, Spetzler RF, et al: Clinical vasospasm after subarachnoid hemorrhage: response to hypervolemic hemodilution and arterial hypertension. Stroke 18:365–372, 1987.

2) Origitano TC, Wascher TM, Reichman OH, et al: Sustained increased cerebral blood flow with prophylactic hypertensive hypervolemic hemodilution (“triple-H therapy”) after subarachnoid hemorrhage. Neurosurgery 27:729–740, 1990.

3)Allen GS, Ahn HS, Preziosi TJ, et al: Cerebral arterial spasm—a controlled trial of nimodipine in patients with subarachnoid hemorrhage. N Engl J Med 308:619–624, 1983.

4) Barker FG II, Ogilvy CS: Efficacy of prophylactic nimodipine for delayed ischemic deficit after subarachnoid hemorrhage: a metaanalysis. J Neurosurg 84:405–414, 1996.

5) Feigin VL, Rinkel GJ, Algra A, et al: Calcium antagonists in patients with aneurysmal subarachnoid hemorrhage: a systematic review. Neurology 50:876–883, 1998.

6) Elliott JP, Newell DW, Lam DJ, et al: Comparison of balloon angioplasty and papaverine infusion for the treatment of vasospasm following aneurysmal subarachnoid hemorrhage. J Neurosurg 88:277–284, 1998.

7) Eskridge JM, McAuliffe W, Song JK, et al: Balloon angioplasty for the treatment of vasospasm: results of first 50 cases. Neurosurgery 42:510–517, 1998.

8) Corsten L, Raja A, Guppy K, et al: Contemporary management of subarachnoid hemorrhage and vasospasm: the UIC experience. Surg Neurol 56:140–150, 2001.

9) Findlay JM, Kassell NF, Weir BK, et al: A randomized trial of intraoperative, intracisternal tissue plasminogen activator for the prevention of vasospasm. Neurosurgery 37:168–178, 1995.

10) Kassell NF, Torner JC, Haley EC Jr, et al: The International Cooperative Study on the Timing of Aneurysm Surgery. Part 1: Overall management results. J Neurosurg 73:18–36, 1990.

14) Hoekema D, Schmidt RH, Ross I. Lumbar drainage for subarachnoid hemorrhage: technical considerations and safety analysis. Neurocrit Care.7:3-9,2007.

15) Inagawa T, Kamiya K, Matsuda T: Effect of continuous cisternal drainage on cerebral vasospasm. Acta Neurochir 112:28–36,1991.

16) Kasuya H, Shimizu H, Kagawa M: The effect of continuous drainage of cerebrospinal fluid in patients with subarachnoid hemorrhage:a retrospective analysis of 108 patients. Neurosurgery 28:56–59, 1991.

17) Klimo P Jr, Kestle JR, MacDonald JD, Schmidt RH. Marked reduction of cerebral vasospasm with lumbar drainage of cerebrospinal fluid after subarachnoid hemorrhage. J Neurosurg. 100:215-24,2004.

18) Mizoi K, Yoshimoto T, Takahashi A, et al: Prospective study on the prevention of cerebral vasospasm by intrathecal fibrinolytic therapy with tissue-type plasminogen activator. J Neurosurg 78:430–437, 1993.

19) Sasaki T, Ohta T, Kikuchi H, et al: A phase II clinical trial of recombinant human tissue-type plasminogen activator against cerebral vasospasm after aneurysmal subarachnoid hemorrhage. Neurosurgery 35:597–605, 1994.

20)Kasuya H, Shimizu T, Okada T, Takahashi K, Summerville T, Kitamura K. A study of continuous cerebrospinal fluid drainage in patients with subarachnoid hemorrhage. No Shinkei Geka. 16:475-81; 1988.

21) Sasaki T, Kodama N, Kawakami M, et al: Urokinase cisternal irrigation therapy for prevention of symptomatic vasospasm after aneurismal subarachnoid hemorrhage: a study of urokinase concentration and the fibrinolytic system. Stroke 31:1256–1262, 2000.

22) Kawamoto S, Tsutsumi K, Yoshikawa G, Shinozaki MH, Yako K, Nagata K, Ueki K. Effectiveness of the head-shaking method combined with cisternal irrigation with urokinase in preventing cerebral vasospasm after subarachnoid hemorrhage. J Neurosurg.100:236-43, 2004.

23) Kwon OY, Kim YJ, Kim YJ, Cho CS, Lee SK, Cho MK. The Utility and Benefits of External Lumbar CSF Drainage after Endovascular Coiling on Aneurysmal Subarachnoid Hemorrhage. J Korean Neurosurg Soc.43:281-7;2008.

24) Vatter H, Mursch K, Zimmermann M, Zilliken P, Kolenda H, Seifert V, et al : Endothelin-converting enzyme activity in human cerebral circulation. Neurosurgery 51 : 445-451; 2002.

25) Asano T, Takakura K, Sano K, Kikuchi H, Nagai H, Saito I, et al : Effects of a hydroxyl radical scavenger on delayed ischemic neurological deficits following aneurysmal subarachnoid hemorrhage : results of a multicenter, placebo-controlled double-blind trial. J Neurosurg 84 : 792-803, 1996.

26) Kamezaki T, Yanaka K, Nagase S : Increased levels of lipid peroxidase as predictive of symptomatic vasospasm and poor outcome after aneurysmal subarachnoid hemorrhage. J Neurosurg 97 : 1302- 1305, 2002.

27)Otawara Y, Ogasawara K, Kubo Y, Sasoh M, Ogawa A. Effect of continuous cisternal cerebrospinal fluid drainage for patients with thin subarachnoid hemorrhage. Vasc Health Risk Manag. 3:401-4, 2007.

28) Hänggi D, Eicker S, Beseoglu K, Behr J, Turowski B, Steiger HJ. A multimodal concept in patients after severe aneurysmal subarachnoid hemorrhage: results of a controlled single centre prospective randomized multimodal phase I/II trial on cerebral vasospasm. Cen Eur Neurosurg. 70:61-7, 2009.

29) Fisher CM, Kistler JP, Davis JM. Relation of cerebral vasospasm to subarachnoid hemorrhage visualized by computerized tomographic scanning. Neurosurgery 6: 1-9;1980.

30) Rabb CH, Tang G, Chin LS, Giannotta SL. A statistical analysis of factors related to symptomatic vasospasm. Acta Neurochir (Wien), 127: 27-31; 1994.

31) Inagawa T. Cerebral vasospasm in elderly patient treated by early operation for ruptured intracranial aneurysms. Acta Neurochir (Wien), 115: 79-85; 1992.

32) Lasner TM, Weil RJ, Riina HA, King JT, Zager EL, Raps EC, Flamm ES. Cigarette smoking-induced increase in the risk of symptomatic vasospasm after aneurysmal subarachnoid hemorrhage. J Neurosurg, 87: 381-384; 1997.

33) Hirashima Y, Endo S, Kato R, Takaku A. Indications for cisternal irrigation with urokinase in postoperative patients with aneurysmal subarachnoid haemorrhage. Br J Neurosurg. 10:477-81; 1996.

34) Yamada K, Yoshimura S, Enomoto Y, Yamakawa H, Iwama T. Effectiveness of combining continuous cerebrospinal drainage and intermittent intrathecal urokinase injection therapy in preventing symptomatic vasospasm following aneurysmal subarachnoid haemorrhage. Br J Neurosurg. 22:649-53;2008.

35) Kinouchi H, Ogasawara K, Shimizu H, Mizoi K, Yoshimoto T. Prevention of symptomatic vasospasm after aneurysmal subarachnoid hemorrhage by intraoperative cisternal fibrinolysis using tissue-type plasminogen activator combined with continuous cisternal drainage. Neurol Med Chir (Tokyo). 44:569-75; 2004.