Middle meningeal artery embolization for chronic subdural hematoma

Chronic subdural hematoma is fundamentally a disorder of the meningeal blood vessels.

Embolization of the middle meningeal artery (MMA) has recently been proposed as a curative treatment for chronic subdural hematoma (cSDH), but evidence for the indication and timing is not definitive.

Fiorella and Arthur reviewed the potential role for the endovascular management of cSDH within the context of a discussion of the epidemiology, pathophysiology, and conventional management of this disease.

**Trials**

https://clinicaltrials.gov/ct2/show/NCT03307395

**Systematic Reviews**

Middle meningeal artery embolization for chronic subdural hematoma systematic reviews.

**Case series**

A review was registered with the International prospective register of systematic reviews (PROSPERO). Public/Publisher Medline (PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Excerpta Medica database (EMBASE) and the Cochrane Library were searched using Medical Subject Headings (MeSH) terms for MMA embolization and CSDH from January 2000 through November 2018. All articles in the English language literature describing MMA embolization...
for CSDH were included, irrespective of study design. Consecutive patients who underwent MMA embolization at our hospital from January 2017 through June 2018 comprised our clinical experience.

Fifteen studies with 193 procedures were included in the review. Ninety-five (49.2%) cases involved primary MMA embolization; 88 (45.6%) embolization for recurrent CSDH, and 10 (5.2%) were performed for prophylaxis after surgical evacuation. Recurrence after MMA embolization requiring further treatment occurred in 7 (3.6%) cases. All other patients had symptomatic relief with no further recurrence. No procedure-related complications were reported. Polyvinyl alcohol was the most commonly used material. Our series included 8 patients treated with Onyx (Medtronic). All had symptom relief and significant reduction in hematoma size; no recurrences or procedure-related complications were observed.

Nakagawa et al., retrospectively assessed data from 381 consecutive patients who underwent burr hole irrigation for CSDH between 2009 and 2017. Recurrent symptomatic ipsilateral CSDH in 71 (18%) patients was treated by a second burr-hole irrigation and 20 of them had a further symptomatic CSDH recurrence thereafter. Those with persistent ipsilateral CSDH recurrence were treated by MMA embolization. Before the MMA embolization procedures, the amount of hematoma membrane enhancement determined using superselective MMA angiography-DynaCT imaging was classified into three stages.

Embolization of the MMA proceeded without perioperative complications or further CSDH recurrence. The interval between recurrence and the amount of hematoma membrane enhancement significantly correlated (first to second and second to third treatments: p = 0.012 and p = 0.017, respectively). The frequency of bilateral CSDH was significantly higher and the recurrence interval between the first and second treatments was significantly shorter in repeated recurrences group compared with recurrence group (p = 0.023 and p = 0.006, respectively).

Repeatedly recurrent CSDH can be safely treated and cured by MMA embolization. Hematoma membrane enhancement pattern using DynaCT images can predict repeated recurrences CSDH.

Five patients with symptomatic chronic SDHs underwent MMA embolization using PVA microparticles. Size of SDH was recorded in maximum diameter and total volume.

Four patients underwent unilateral and 1 underwent bilateral MMA embolization successfully. All cases had significant reduction in total volume of SDH at longest follow-up scan: 81.4 to 13.8 cc (7 wk), 48.5 to 8.7 cc (3 wk), 31.7 and 88 to 0 and 17 cc (14 wk, bilateral), 79.3 to 24.2 cc (8 wk), and 53.5 to 0 cc (6 wk). All patients had symptomatic relief with no complications. Histologic analysis of the chronic SDH membrane in a separate patient that required surgery revealed rich neovascularization with many capillaries and few small arterioles.

MMA embolization could present a minimally invasive and low-risk initial treatment alternative to surgery for symptomatic chronic SDH when clinically appropriate.

MMA embolization was performed using angiography, selective microcatheterization of the MMA, and infusion of polyvinyl alcohol particles. Outcomes were assessed clinically and with interval imaging.
MMA embolization was performed successfully on 60 total SDHs in 49 patients. This includes upfront treatment for new (not previously treated) SDH in 42, for recurrence in 8, and prophylaxis (soon after surgical evacuation) in 10. There were 3 mortalities (unrelated to the procedure), and no procedural complications. Of the 50 nonprophylactic cases, there were 4 (8.9%) cases of recurrence requiring surgical evacuation, and 31 (68.9%) that had resolution or reduction in size >50% of SDH at longest follow-up. Overall, 41 (91.1%) were stable or decreased in size and able to avoid surgery.

MMA embolization may represent a minimally-invasive alternative to surgery for new or recurrent chronic SDH, or as prophylaxis to reduce the risk of recurrence after surgery. Given our encouraging results with a 91% long-term success rate, a large scale clinical trial is warranted.5


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Seventy-two prospectively enrolled patients with CSDH underwent MMA embolization (embolization group; as the sole treatment in 27 [37.5%] asymptomatic patients and with additional hematoma removal for symptom relief in 45 [62.5%] symptomatic patients). For comparison, 469 patients who underwent conventional treatment were included as a historical control group (conventional treatment group; close, nonsurgical follow-up in 67 [14.3%] and hematoma removal in 402 [85.7%] patients). Primary outcome was treatment failure defined as a composite of incomplete hematoma resolution (remaining or reaccumulated hematoma with thickness > 10 mm) or surgical rescue (hematoma removal for relief of symptoms that developed with continuous growth of initial or reaccumulated hematoma). Secondary outcomes included surgical rescue as a component of the primary outcome and treatment-related complication for safety measure. Six-month outcomes were compared between the study groups with logistic regression analysis. Results Spontaneous hematoma resolution was achieved in all of 27 asymptomatic patients without direct hematoma removal. Hematoma reaccumulation occurred in one (2.2%) of 45 symptomatic patients receiving embolization with additional hematoma removal. Treatment failure rate in the embolization group was lower than in the conventional treatment group (one of 72 patients [1.4%] vs 129 of 469 patients [27.5%], respectively; adjusted odds ratio [OR], 0.056; 95% confidence
interval [CI]: 0.011, 0.286; P = .001). Surgical rescue was less frequent in the embolization group (one of 72 patients [1.4%] vs 88 of 469 patients [18.8%]; adjusted OR, 0.094; 95% CI: 0.018, 0.488; P = .005). Treatment-related complication rate was not different between the two groups (0 of 72 patients vs 20 of 469 patients [4.3%]; adjusted OR, 0.145; 95% CI: 0.009, 2.469; P = .182). Conclusion MMA embolization has a positive therapeutic effect on CSDH and is more effective than conventional treatment).

Gobran Taha Alfotih reported 14 cases

Case reports

A case of a 74-year-old male on aspirin with a history of recurrent symptomatic chronic right-sided subdural hematoma treated successfully with a SEPS and right middle meningeal artery embolization with poly vinyl alcohol (PVA) microparticles. The patient initially presented to the emergency department with headaches, difficulty walking, and left sided hemiparesis. CT Head showed a large chronic right-sided subdural hematoma measuring 2.7 cm thick with 1 cm of leftward shift. Patient underwent placement of a right-sided SEPS and the subdural hematoma decreased in size to 1.0 cm with 2 mm of leftward shift. The patient had resolution of headaches and neurological symptoms and was discharged home. Three months later, the patient returned to the emergency department with headache and left hand numbness. CT Head showed an acute on chronic right-sided subdural hematoma measuring 1.4 cm with 3 mm of leftward shift. Patient underwent right-sided SEPS placement. Repeat CT Head showed reduction in the subdural hematoma to 1.2 cm. The SEPS was removed and the patient had resolution of neurological symptoms. The patient then had a diagnostic cerebral angiogram with PVA microparticle embolization of the right middle meningeal artery. A SEPS was placed at the time of the angiogram to further reduce the size of the subdural hematoma. Repeat CT Head after SEPS and middle meningeal artery embolization showed decrease in size of the subdural hematoma. Follow-up CT Head showed stability of the subdural hematoma and patient had no further neurological symptoms. Patient was discharged home.

Middle meningeal artery embolization is a useful endovascular technique for reducing the arterial supply to the membranes in chronic subdural hematomas. Middle meningeal artery embolization can reduce the recurrence rate of subdural hematomas.

References


3) Nakagawa I, Park HS, Kotsugi M, Wada T, Takeshima Y, Matsuda R, Nishimura F, Yamada S, Motoyama Y, Park YS, Kichikawa K, Nakase H. Enhanced hematoma membrane on DynaCT images during middle...


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