Squid

• Evaluating the role of HR 3D-CBCT and squid 12 embolic agent in meningioma management: Insights from MRI modifications at follow-Up

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- Antimicrobial management of unresectable embolisation agent infection: A case report
- MIDDLE MENINGEAL ARTERY EMBOLIZATION FOR ACUTE EPIDURAL HEMATOMAS: A PROMISING ALTERNATIVE TO TRADITIONAL SURGERY
- Hemodynamic Instability during Squid Embolization of Dural Arteriovenous Fistula: A Case Report
- Penetration of Non-Adhesive Gel-like Embolic Materials During Dural Vessels Embolization According to Characteristics of Tantalum Powder
- Performance of optically pumped magnetometer magnetoencephalography: validation in large samples and multiple tasks
- Safety and efficacy of newer liquid embolic agents Squid and PHIL in endovascular embolization of cerebral arteriovenous malformations and dural arteriovenous fistulas: A systematic review and meta-analysis
- Corpus callosum granuloma after endovascular squid embolisation of a ruptured arteriovenous malformation

(Balt Extrusion, Montmorency, France) https://baltgroup.com/products/squid/

Squid is a non-adhesive liquid embolic agent used in endovascular procedures to occlude blood vessels, particularly in cerebral arteriovenous malformation treatment and dural arteriovenous fistulas (DAVFs). It is composed of an ethylene-vinyl alcohol copolymer (EVOH) suspended in dimethyl sulfoxide (DMSO), with micronized tantalum powder added for radiopacity, allowing for clear visualization during imaging.

Properties and Composition:

- **EVOH Copolymer:** Provides the embolic material with its solidifying properties upon contact with blood. - **Dimethyl Sulfoxide (DMSO):** Acts as a solvent, facilitating the delivery of the EVOH copolymer through microcatheters. - **Micronized Tantalum Powder:** Enhances radiopacity, ensuring the embolic agent is visible during fluoroscopic imaging.

Clinical Applications:

Squid is primarily utilized in the embolization of cerebral AVMs and DAVFs. Its non-adhesive nature reduces the risk of microcatheter entrapment, a common complication associated with other embolic agents like cyanoacrylates. Additionally, Squid's formulation allows for controlled and predictable solidification, which is crucial for effective embolization.

Safety and Efficacy:

Studies have demonstrated that Squid is both safe and effective for the endovascular treatment of high-grade DAVFs. A prospective, multicenter study reported a complete occlusion rate of 93.2% at 90 to 180 days post-treatment, with a low complication rate. Another systematic review and metaanalysis indicated that Squid, along with PHIL, offers high complete occlusion rates and low morbidity in the treatment of both AVMs and DAVFs.

Advantages:

- **Non-Adhesive Nature:** Minimizes the risk of microcatheter entrapment. - **Controlled Solidification:** Allows for predictable embolization outcomes. - **Enhanced Radiopacity:** Facilitates precise visualization during procedures.

Considerations:

While Squid offers several advantages, clinicians need to be aware of potential challenges, such as the need for DMSO-compatible microcatheters and the possibility of early distal embolization. Careful patient selection and procedural planning are crucial to mitigate these risks.

In summary, Squid represents a significant advancement in liquid embolic agents, providing a safer and more effective option for the endovascular treatment of cerebral AVMs and DAVFs.

Günkan et al. assessed the safety and efficacy of EVT of cAVMs and dAVFs using Squid or PHIL as an embolic agent.

They searched major databases following PRISMA guidelines and included studies with \geq five patients reporting on EVT of dAVFs and/or cAVMs using Squid or PHIL as an embolic agent. We analyzed efficacy outcomes including complete occlusion, incomplete occlusion, and recurrence at follow-up, and safety outcomes including procedure-related complications, morbidity, and mortality with a random-effects meta-analysis. Separate analyses were performed for cAVMs and dAVFs. Subanalyses were conducted for studies exclusively utilizing PHIL and those exclusively utilizing Squid, for both cAVMs and dAVFs.

Ten studies, comprising 214 patients (53.7% male), were found. Of these, 113 patients had 113 dAVFs, while 101 patients had 101 cAVMs. Complete occlusion rates following embolization were 91% for dAVFs and 32% for cAVMs. A subanalysis of dAVFs embolized solely with Squid and PHIL identified 93% and 86% complete occlusion rates, respectively. The overall procedure-related permanent morbidity rate was 3% for dAVFs and 7% for cAVMs. There was only one procedure-related mortality, which developed in a cAVM case, across 214 cases.

Squid and PHIL are safe and effective embolic agents for the treatment of dAVFs and cAVMs ¹⁾.

This meta-analysis provides valuable insights into the safety and efficacy of Squid and PHIL as liquid embolic agents for treating dAVFs and cAVMs. The high occlusion rates and low complication rates suggest that these agents are effective and safe, supporting their growing use in neurointerventional procedures. However, the study's limitations, including the lack of long-term follow-up data, heterogeneity in included studies, and absence of comparisons to other agents, suggest that further research is needed to fully establish their clinical superiority. Future randomized controlled trials with larger patient populations and longer follow-up durations will be essential to confirm these results and guide clinical decision-making.

Case reports

A late adolescent patient was admitted after a collapse and was found to have an intracranial

hemorrhage due to an underlying midline arteriovenous malformation (AVM). The patient underwent trans-arterial squid embolization of the AVM with good radiological resolution. 18 months later, the patient presented with new onset headaches. Cranial imaging demonstrated an enhancing lesion at the site of the previously thrombosed AVM in the corpus callosum. This was deemed to be a foreign body granuloma, a rare complication of intravascular embolization of AVMs. The patient continued to have periodic imaging with subsequent scans demonstrating progressive changes in the granuloma and this was then resected surgically. We describe the natural history of the granuloma formation, outline the cranial imaging features associated with this rare condition, and review the literature of similar cases²

The report could benefit from a more in-depth exploration of the pathophysiology of granuloma formation, as well as a more robust review of the literature and long-term patient outcomes. While this is a unique and interesting case, further studies involving larger cohorts are necessary to better understand the prevalence and management of this complication.

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Günkan A, Ferreira MY, Vilardo M, Scarcia L, Bocanegra-Becerra JE, Alexandre A, Ferreira C, Dmytriw A, Ciccio G, Clarençon F, Jabbour P, Serulle Y. Safety and efficacy of newer liquid embolic agents Squid and PHIL in endovascular embolization of cerebral arteriovenous malformations and dural arteriovenous fistulas: A systematic review and meta-analysis. Interv Neuroradiol. 2024 Oct 17:15910199241288897. doi: 10.1177/15910199241288897. Epub ahead of print. PMID: 39569607.

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