

# Outcome angioembolization in patient with high-flow priapism: A systematic review

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## Abstract

High-flow priapism (HFP) is a rare disorder that causes prolonged, painless erections. Because it has the potential to permanently damage erectile function, HFP should be promptly treated to regain potency. The suggested therapies for nonischemic priapism include surgical ligation of the arteriocavernous fistulae or selective arterial embolization. However, extensive studies regarding angioembolization in priapismus patients are still lacking, while most of them were case reports, this article aimed to compile and reviewed the available studies regarding therapeutic angioembolization as the management modality of priapism. This systematic review was carried out using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklists. We included 16 studies involving 52 patients in this review. Our review found that angioembolization had favorable rates of clinical symptom alleviation and favorable rates of erectile function improvement.

**Keywords:** Angioembolization, erectile dysfunction, high-flow priapism

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## INTRODUCTION

High-flow priapism (HFP) is a rare disorder that causes prolonged, painless erections.<sup>[1]</sup> Because it has the potential to permanently damage erectile function, HFP should be promptly treated to regain potency.<sup>[2]</sup>

Surgery is the conventional treatment for high-flow priapism, however, when compared to arterial embolotherapy, it is less effective.<sup>[3-5]</sup> If local treatment is ineffective, transarterial embolization is a helpful alternative.<sup>[6]</sup> The suggested therapies include surgical ligation of the arteriocavernous fistulae or selective arterial embolization.<sup>[7]</sup>

Extensive studies regarding angioembolization in priapismus are still lacking. Thus, we aimed to compile and reviewed the available studies regarding therapeutic angioembolization as the management modality of priapism.

## METHODS

### Search strategy

This systematic review was carried out using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklists. We conducted a comprehensive systematic review in PubMed, Cochrane, and ProQuest databases during October 23–25, 2022.

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### Eligibility criteria

We included studies regarding the utilization of embolization in the management of HFP. This study does not restrict to a particular study design. Inclusion of the article included articles in English, full-text available. Exclusion criteria included review articles, commentary articles, editorials, and study not evaluating the outcome of interest. Any ambiguity or discrepancies were resolved by discussion among authors. The PRISMA flow diagram was used to guide the study selection process, and all the authors approved the final list of selected articles to be included in this systematic review.

### Data extraction and outcome

The key outcome measure was the use of embolization in HFP patient and their effect was measured by either detumescence or erectile function.

## RESULTS

Database searching identified a total of 383 articles, and they were screened depending on the criteria for inclusion and exclusion included in the study selection. Of these, 41 articles passed the screening process and resulted in 16 articles for full-text assessment. Hence, we included 16 studies involving 52 patients in this review [Figure 1]. All the reviewed studies were published between 2012 and 2022. Details of the studies are shown in Table 1.

Within 2 weeks following embolization, symptoms improved in 52 out of the 52 patients (100%) in total. Fifty-one out of 52 individuals (98.1%) who had embolization had their erectile function return. Regarding occlusive agents, temporary occlusive agents (Gelfoam) were employed in 26 patients, and in 26 of the 26 patients, priapism was improved (100%) as a result. After embolization, erectile function was restored in 25 out of 26 patients (96.2%). Priapism improved in all 26 patients treated with permanent occlusive agents (microcoils and polyvinyl alcohol [PVA]) (100%), and after embolization, erectile function returned in 26 of 26 patients (100%). In other words, angioembolization had favorable rates of clinical symptom alleviation and favorable rates of erectile function improvement.

## DISCUSSION

Less often occurring nonischemic priapism, commonly referred to as high-flow or arterial priapism, is typically caused by a fistula between the cavernosal artery and corpus cavernosum. The most common cause of HFP is a traumatic arteriocavernosal fistula, which does not result in ischemia but instead causes the corpus cavernosa to

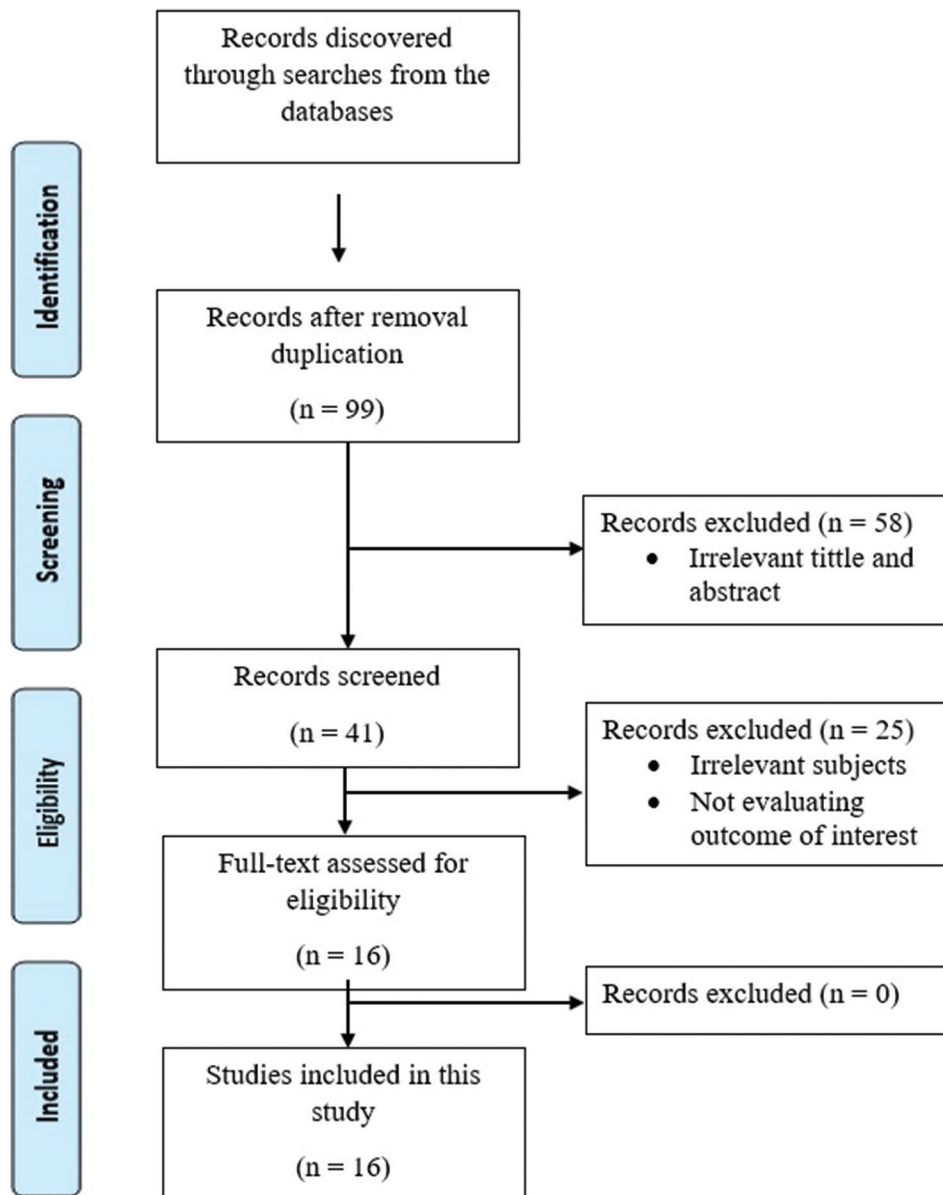
develop painlessly. This kind of priapism has been linked to external trauma, aggressive sexual behavior, cycling, and a few hematological conditions (leukemia and sickle cell anemia).<sup>[24]</sup> Comparison of both type priapism symptoms shown in Table 2.

The perforating arteries from the penile artery will be lacerated as a result of the trauma. In contrast to low-flow priapism, the erection is partial and not painful at clinical presentation. The cavernosal blood gas sample has a high  $PO_2$  ( $>90$  mmHg) and pH ( $>7.4$ ) level because oxygenated blood is pumped into the corpus cavernosum.<sup>[25]</sup> Since priapism frequently resolves on its own, the initial course of treatment is either observation or compression therapy.<sup>[26]</sup> The drawbacks of watchful waiting include potential structural changes brought on by increased vascular inflow, which may result in impotence as well as conditions-related social and psychological challenges that should be resisted.<sup>[27]</sup> Ice packs, mechanical decompression, intracavernosal injections of alpha-agonists, surgical closure of the cavernosal artery, and targeted embolization of the feeder vessels are some of the treatments for HFP.

Embolization is presently the preferred form of treatment since it is less intrusive and has a greater success rate than surgery, with reported rates ranging from 5% to 33% depending on whether the embolic agent is temporary or permanent.<sup>[28]</sup> The goal is to close the vascular fistula and achieve detumescence without harming the nearby healthy tissue and erectile function. Ultra-selective angiography of the pudendal artery is required even if no pathological angiographic symptoms are seen from the diagnostic catheter to identify angiographic signs.<sup>[29]</sup>

Angioembolization is carried out using a variety of materials. Temporary and permanent occlusives are the two categories to which these materials adhere. Permanent occlusives are made of materials such as microcoil, N-butyl cyanoacrylate, and PVA particles, whereas temporary occlusives are made of substances such as autologous blood clots and gel foam metal. The effectiveness of the two groups is about equal, however, in temporary groups, problems such as erectile dysfunction (ED) are less common.<sup>[30]</sup> However, more research is required to fully describe these results.

Deploying a microcoil has a number of benefits, particularly due to its radiopacity, fast accuracy, and cavity packability, i.e. into a pseudoaneurysm. This enables the culprit lesion to be treated without unintentionally eradicating nearby tributaries. In addition, the insertion of the coil (opportunisticly) provided as a marker for



**Figure 1:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram

the targeted perineal-US location of the pseudoaneurysm in this case without compromising the picture quality.<sup>[17]</sup> Even though coils produced good results, when dealing with several unilateral feeding vessels, liquid embolic agents should be taken into account to encourage the eventual recanalization of native artery supply and lower the likelihood of developing ED in the future.<sup>[31]</sup>

Embolization complications could result in ED, ischemia/necrosis, inflammation, or abscess development. According to reports, up to 39% of EDs involving nonabsorbable materials occur;<sup>[9]</sup> however, only one patient with a right femoral pseudoaneurysm reported having an ED. Despite the need for more research into the elements

that affect how long it takes for erectile function to recover, a 2018 study indicated that temporary selective arterial embolization had a 90% success rate in resolving HFP while maintaining long-term erectile function. This predicts even better long-term results for those who receive selective embolization.<sup>[32]</sup>

The limitation of this study is that this study has small number of patients in each study, most of the included studies have a short follow-up period, and most of the studies with long follow-ups were using absorbable embolization agents. The authors of this study recommend to other researchers not to overlook these limitations.

**Table 1: Summary of the studies**

Study	Year of publication	Number of patients	Embolic agent	Detumescence	Restoration of erectile function	Follow-up (weeks)	Outcome
Puri <i>et al.</i> <sup>[8]</sup>	2021	1	Gelfoam	1/1	1/1	2	Effective
Bi <i>et al.</i> <sup>[9]</sup>	2020	14	Gelfoam/PVA/microcoils	14/14	14/14	1	Effective
Acampora <i>et al.</i> <sup>[10]</sup>	2021	1	Microcoils	1/1	1/1	12	Effective
De Magistris <i>et al.</i> <sup>[11]</sup>	2020	9	Gelfoam/PVA/microcoils	9/9	9/9	6	Effective
Cakiroglu <i>et al.</i> <sup>[12]</sup>	2023	1	Microcoil	1/1	1/1	1	Effective
Qi <i>et al.</i> <sup>[13]</sup>	2018	6	PVA	6/6	6/6	1	Effective
Filho <i>et al.</i> <sup>[14]</sup>	2018	1	Gelfoam	1/1	1/1	28	Effective
Munshi <i>et al.</i> <sup>[15]</sup>	2020	1	Gelfoam	1/1	0/1	1	Effective with side effects of ED
Sánchez-López <i>et al.</i> <sup>[16]</sup>	2017	1	PVA	1/1	1/1	2	Effective
Williams and Lax <sup>[17]</sup>	2021	1	microcoils	1/1	1/1	24	Effective
Kato <i>et al.</i> <sup>[18]</sup>	2019	4	Gelfoam	4/4	4/4	4	Effective
Bianchi <i>et al.</i> <sup>[19]</sup>	2018	1	Microcoils	1/1	1/1	3	Effective
Prattley <i>et al.</i> <sup>[20]</sup>	2019	1	Gelfoam+microcoils	1/1	1/1	48	Effective
Allameh <i>et al.</i> <sup>[21]</sup>	2022	1	Gelfoam	1/1	1/1	8	Effective
Zhao <i>et al.</i> <sup>[22]</sup>	2013	8	Gelfoam	8/8	8/8	48	Effective
Otten <i>et al.</i> <sup>[23]</sup>	2022	1	Gelfoam	1/1	1/1	12	Effective

PVA: Polyvinyl alcohol, ED: Erectile dysfunction

**Table 2: Key findings in the evaluation of priapism**

Finding	Ischemic priapism	Nonischemic priapism
Corpora cavernosa fully rigid	Usually present	Seldom present
Penile pain	Usually present	Seldom present
Abnormal cavernous blood gases	Usually present	Seldom present
Blood abnormalities and hematologic malignancy	Sometimes present	Seldom present
Recent intracavernous vaso-active drug injections	Sometimes present	Seldom present
Chronic, well-tolerated tumescence without full rigidity	Seldom present	Usually present
Perineal trauma	Seldom present	Sometimes present

## CONCLUSION

According to our reviews, angioembolization completely resolves the condition in more than 90% of patients with HFP. Following embolization, erectile function appears to have been retained, as per the long-term follow-up.

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## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Anele UA, Le BV, Resar LM, Burnett AL. How I treat priapism. *Blood* 2015;125:3551-8.
2. Yesilkaya Y, Peynircioglu B, Gulek B, Topcuoglu M, Inci K. Autologous blood-clot embolisation of cavernosal artery pseudoaneurysm causing delayed high-flow priapism. *Pol J Radiol* 2013;78:54-6.
3. Savoca G, Pietropaolo F, Scieri F, Bertolotto M, Mucelli FP, Belgrano E. Sexual function after highly selective embolization of cavernous artery in patients with high flow priapism: Long-term follow-up. *J Urol* 2004;172:644-7.
4. Song PH, Moon KH. Priapism: Current updates in clinical management. *Korean J Urol* 2013;54:816-23.
5. Oztürk MH, Gümüş M, Dönmez H, Peynircioglu B, Onal B, Dinç H. Materials in embolotherapy of high-flow priapism: Results and long-term follow-up. *Diagn Interv Radiol* 2009;15:215-20.
6. O'Sullivan P, Browne R, McEniff N, Lee MJ. Treatment of "high-flow" priapism with superselective transcatheter embolization: A useful alternative to surgery. *Cardiovasc Intervent Radiol* 2006;29:198-201.
7. Kim KR, Shin JH, Song HY, Ko GY, Yoon HK, Sung KB, *et al.* Treatment of high-flow priapism with superselective transcatheter embolization in 27 patients: A multicenter study. *J Vasc Interv Radiol* 2007;18:1222-6.
8. Puri S, Swietlik J, Ozkan O, Kleedehn M. Superselective embolization in posttraumatic high-flow priapism. *Clin Imaging* 2021;80:274-6.
9. Bi Y, Yi M, Yu Z, Han X, Ren J. Superselective embolization for high-flow priapism refractory to medical and surgical treatments. *BMC Urol* 2020;20:79.
10. Acampora C, Borzelli A, Di Serafino M, Iacobellis F, Barbuto L, D'errico C, *et al.* High-flow post-traumatic priapism: Diagnostic and therapeutic workup. *J Ultrasound* 2021;24:539-45.
11. De Magistris G, Pane F, Giurazza F, Corvino F, Coppola M, Borzelli A, *et al.* Embolization of high-flow priapism: Technical aspects and clinical outcome from a single-center experience. *Radiol Med* 2020;125:288-95.
12. Cakiroglu B, Kaya C, Aksoy SH. A case of a high-flow priapism treated with superselective transcatheter embolization. *Urologia* 2023;90:419-21.
13. Qi T, Ye L, Chen Z, Huang ZS, Wang B, Li H, *et al.* Efficacy and safety of treatment of high-flow priapism with superselective transcatheter embolization. *Curr Med Sci* 2018;38:101-6.
14. Filho LG, Nasser F, Ingrund JC, Burihan MC, Brandão GD, Budib IJ. High-flow priapism and urinary retention. *Urol Case Rep* 2018;19:48-9.
15. Munshi FI, Kwon YS, Gibbens DT, Mahmood P, Gazi M, Olweny EO. High-flow priapism treated with selective embolization of a helicine branch of the penile artery: A case report and selected review of the literature. *Urol Ann* 2020;12:103-5.
16. Sánchez-López S, González-Gómez S, Di Lizio-Miele K, González-Gómez J. High-flow priapism treated with superselective

- transcatheter embolization using polyvinyl alcohol particles. SAGE Open Med Case Rep 2017;5:2050313×17693179.
17. Williams AB, Lax LG. A rare case of post-traumatic high-flow priapism requiring endovascular salvage with bilateral superselective microcoil embolization. J Surg Case Rep 2021;2021:rjab077.
18. Kato T, Mizuno K, Nishio H, Iwatsuki S, Nakane A, Akita H, *et al.* Appropriate management of high-flow priapism based on color Doppler ultrasonography findings in pediatric patients: Four case reports and a review of the literature. J Pediatr Urol 2019;15:187.e1-e6.
19. Bianchi G, Sachs C, Campo I, Liguori G, Trombetta C. Selective arterial embolization for a high-flow priapism following perineal trauma in a young gymnast. Arch Ital Urol Androl 2018;90:218-9.
20. Prattley S, Bryant T, Rees R. Superselective embolization with microcoil and gelfoam for high-flow priapism secondary to bilateral cavernous fistulae: A case study. Case Rep Urol 2019;2019:3916056.
21. Allameh F, Khameneh Bagheri A, Hojjati SA, Faraji S, Eslami A. Gelfoam embolization of high-flow priapism due to coitus: A case report. Urol Case Rep 2022;41:101970.
22. Zhao S, Zhou J, Zhang YF, Zhang XL, Long QY. Therapeutic embolization of high-flow priapism 1 year follow up with color Doppler sonography. Eur J Radiol 2013;82:e769-74.
23. Otten MJ, Zuur LG, Florie J, van Bezooijen BP. Endovascular embolization of posttraumatic high-flow priapism: Uncommon arteriovenous fistula of the corpus cavernosum. Radiol Case Rep 2022;17:1044-6.
24. Ilicki J, Krauss W, Andersson SO. Partial segmental thrombosis of the corpus cavernosum: A case report and a review of the literature. Urology 2012;79:708-12.
25. Shigehara K, Namiki M. Clinical management of priapism: A review. World J Mens Health 2016;34:1-8.
26. Cherian J, Rao AR, Thwaini A, Kapasi F, Shergill IS, Samman R. Medical and surgical management of priapism. Postgrad Med J 2006;82:89-94.
27. El-Assmy A, Hekal IA, Abou-El-Ghar ME. Use of magnetic resonance angiography in diagnosis and decision making of post-traumatic, high-flow priapism. ScientificWorldJournal 2008;8:176-81.
28. Ingram AR, Stillings SA, Jenkins LC. An update on non-ischemic priapism. Sex Med Rev 2020;8:140-9.
29. Liu BX, Xin ZC, Zou YH, Tian L, Wu YG, Wu XJ, *et al.* High-flow priapism: Superselective cavernous artery embolization with microcoils. Urology 2008;72:571-3.
30. Kojima H, Tanigawa N, Kariya S, Komemushi A, Shomura Y, Yanishi M, *et al.* High-flow priapism undergoing arterial embolization: Review of literature following American Urological Association guideline on the management of priapism. Minim Invasive Ther Allied Technol 2009;18:1-5.
31. Zacharakis E, Ralph DJ, Walkden M, Muneer A. Distal corpus cavernosum fibrosis and erectile dysfunction secondary to non-ischaemic priapism. Arch Ital Urol Androl 2015;87:258-9.
32. Chick JF, Bundy J, Gemmete JJ, Srinivasa RN, Dauw C, Srinivasa RN. Selective penile arterial embolization preserves long-term erectile function in patients with nonischemic priapism: An 18-year experience. Urology 2018;122:116-20.