Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Presentation duration, non-operative detumescence and operative management in ischaemic priapism

Anthony Emmanuel

anthony.emmanuel@nhs.net

Neehar Shetty

Freeman Hospital

Immad Amanulla

Freeman Hospital

Mohamed Mubarak

https://orcid.org/0000-0003-1611-999X

Article

Keywords: Priapism, Phenylephrine, Treatment Failure, Time-to-Treatment, Urologic Surgical Procedures

Posted Date: November 11th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11473277/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: There is **NO** conflict of interest to disclose.

Abstract

Presentation duration may influence non-operative treatment success in ischaemic priapism. This retrospective study analysed 63 episodes managed by corporal aspiration with or without intracavernosal phenylephrine. The primary outcome was successful non-operative detumescence; secondary outcomes were operative management and readmission. Outcomes were compared using a 24-h threshold and continuous logistic regression adjusted for previous priapism. Detumescence occurred in 39/63 episodes (61.9%) and operative management in 19/63 (30.2%). Within versus after 24 h, detumescence was more frequent (82.5% versus 26.1%; $p < 0.001$) and operative management less frequent (12.5% versus 60.9%; $p < 0.001$). Each 6-h delay increased the odds of failed detumescence (OR 1.35, 95% CI 1.13–1.62; $p < 0.001$) and operative management (OR 1.27, 95% CI 1.09–1.48; $p = 0.002$). Presentation duration discriminated failed detumescence (AUC 0.828, 95% CI 0.721–0.935) and operative management (AUC 0.794, 95% CI 0.669–0.919). An exploratory 28-h threshold identified failed detumescence with 70.8% sensitivity and 84.6% specificity and operative management with 73.7% sensitivity and 79.5% specificity. Delay was not independently associated with readmission. Increasing presentation duration was strongly associated with non-operative treatment failure and operative management. Presentation after 24 h sharply reduces successful non-operative detumescence and increases the need for surgery, supporting urgent referral and treatment.

Introduction

Ischaemic priapism (IP) is a compartment syndrome of the corpora cavernosa in which sustained veno-occlusion leads to progressive hypoxia, hypercapnia, and acidosis.[1] Without prompt treatment, these changes may lead to cavernosal smooth-muscle necrosis, corporal fibrosis and permanent erectile dysfunction.[1,2] The European Association of Urology (EAU) and the American Urological Association/Sexual Medicine Society of North America (AUA/SMSNA) recognize IP as a urological emergency, in which the duration of ischaemia is an important determinant of cavernosal smooth-muscle viability and subsequent erectile function.[1,2]

For an erection persisting beyond four hours, current guidelines recommend urgent corporal aspiration with or without irrigation using 0.9% saline, together with intracavernosal administration of a sympathomimetic agent.[1,2] Phenylephrine is the preferred intracavernosal agent because of its α_1-adrenergic selectivity and favourable cardiovascular safety profile compared with less selective sympathomimetics.[1] Operative management is generally reserved for priapism that is refractory to aspiration, irrigation and intracavernosal phenylephrine.[1,2] However, the likelihood of successful non-operative treatment appears to decrease as the duration of ischaemia increases, and the optimum point at which continued medical management should give way to operative intervention remains uncertain.

The biological rationale for time-dependent treatment failure focuses on trabecular oedema and progressive smooth muscle injury brought on by prolonged ischaemia.[3] This results in severe cellular damage and widespread necrosis after approximately 24 hours, with further endothelial destruction and

smooth muscle necrosis after 48 hours.[3] Phenylephrine produces detumescence by stimulating contraction of cavernosal smooth muscle; consequently, its effectiveness is likely to diminish as viable smooth muscle is replaced by necrotic and fibrotic tissue. [3] This provides a plausible mechanism through which a pharmacologically reversible condition may progress to structural corporal failure requiring operative decompression. This has been supported clinically in contemporary series which have reported a considerably shorter IP duration in patients achieving phenylephrine-induced detumescence compared to those who required operative intervention.[4]

Although guidelines emphasize the importance of immediate treatment, there is no definitive evidence establishing a single duration beyond which non-operative management is futile.[1] The relationship between presentation delay, successful detumescence and the need for operative management therefore remains clinically important. This study retrospectively evaluated the management of ischaemic priapism at a tertiary urology centre in the North of England. Its primary objective was to assess the association between the duration of priapism at presentation and the success of non-operative detumescence. Secondary objectives were to evaluate the association between presentation duration and operative management and to explore clinically relevant time thresholds associated with treatment failure.

Methods

This is a retrospective cohort study that included all presentations of ischaemic priapism to the emergency assessment unit of a tertiary urology centre between 1 December 2019 and 31 October 2025. IP episodes were included if active management was undertaken, including non-operative management such as corporal aspiration and intracavernosal phenylephrine injections or operative treatment such as T-shunt, penoscrotal decompression or malleable penile prosthesis. IP episodes that resolved without intervention were excluded.

The primary outcome which was successful non-operative detumescence was defined as a clinically documented sustained detumescence following aspiration with or without intracavernosal phenylephrine, without subsequent non-operative or operative intervention during the same admission. Persistence or recurrence requiring further assessment or admission on the same day was classified as failed detumescence.

Data was collected and extracted in a pre-made template using Microsoft Excel and data analysis was done using IBM SPSS v29 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for distribution and summarised as medians with interquartile ranges (IQR) and, where appropriate, ranges; categorical variables were reported as frequencies and percentages. As presentation duration was right-skewed, outcome groups were compared using the Mann–Whitney U test. Associations between categorical presentation-duration thresholds and outcomes were assessed using two-sided Fisher's exact tests.

The primary categorical analysis compared presentation within and after a clinically selected 24-hour threshold, supported by histopathological and previous clinical evidence.[3–5] Binary logistic regression assessed associations between presentation duration and failed detumescence, operative management and readmission, adjusting for previous priapism; odds ratios were reported per 6- and 12-hour increase. Receiver operating characteristic (ROC) analysis evaluated discrimination for failed detumescence and operative management, with AUCs and 95% confidence intervals reported. The threshold maximising Youden's index was identified as an exploratory data-derived threshold and interpreted separately from the clinically selected 24-hour threshold. Statistical significance was defined as $p < 0.05$.

OpenAI Codex was used to assist with language editing, manuscript structure, reference presentation and journal formatting. It was not used for data collection, statistical analysis or the generation of study results. All AI-assisted suggestions were critically reviewed and verified by the authors, who take full responsibility for the accuracy and integrity of the manuscript.

Results

The cohort comprised 63 priapism episodes, representing 44 identifiable patients. Median time to presentation was 18 hours (IQR 8–38; range 3–168), and median patient age was 45.0 years (IQR 35.9–51.9). Previous ischaemic priapism was documented in 24/63 episodes (38.1%). Medication- or intracavernosal injection-associated priapism accounted for 44/63 episodes (69.8%), while 17 (27.0%) were idiopathic and two (3.2%) had other causes (Table 1).

Table 1
Cohort characteristics and aetiology of ischaemic priapism

Characteristic	Value
Priapism episodes	63
Identifiable patients	44
Age, median (IQR), years	45.0 years (IQR 35.9–51.9)
Age range, years	15.0–80.7
Presentation time, median (IQR), hours	18 (8–38)
Presentation-time range, hours	3–168
Previous priapism	24/63 (38.1%)
Aetiology	
Medication/intracavernosal injection-associated	44/63 (69.8%)
Idiopathic	17/63 (27.0%)
Haematological	1/63 (1.6%)
Other	1/63 (1.6%)

Table 2
Rates of successful detumescence and operative management according to priapism duration at presentation

Priapism Duration	Detumescence	Operative management
≤ 12 h	88.9%	11.1%
13–24 h	69.2%	15.4%
25–48 h	27.3%	63.6%
> 48 h	25.0%	58.3%

Overall, successful detumescence was achieved in 39/63 episodes (61.9%), readmission occurred following 21/63 (33.3%), and operative management was required in 19/63 (30.2%). Presentation delay was strongly associated with treatment outcome. Episodes resulting in successful detumescence presented significantly earlier than those with failed detumescence (median 12 [IQR 7–24] versus 44 [23.3–72] hours; $p < 0.001$). Conversely, episodes requiring operative management presented significantly later than those managed non-operatively (48 [26–72] versus 12 [8–24] hours; $p < 0.001$).

This relationship remained apparent when presentation time was categorised using a clinically meaningful 24-hour threshold selected on the basis of histopathological evidence and previous clinical evidence.[3,5] Detumescence was achieved with either phenylephrine or aspiration alone in 33/40

episodes (82.5%) presenting within 24 hours, compared with 6/23 (26.1%) presenting after 24 hours (Fisher's exact $p < 0.001$). Operative management was required in 5/40 episodes (12.5%) presenting within 24 hours and 14/23 (60.9%) presenting after 24 hours ($p < 0.001$). Accordingly, presentation after 24 hours was associated with substantially lower odds of successful detumescence (OR 0.079, 95% CI 0.018–0.297) and higher odds of operative management (OR 10.37, 95% CI 2.69–47.51).

The time-dependent association was also preserved when presentation delay was analysed continuously. After adjustment for previous priapism, every 6-hour delay was associated with a 35% increase in the odds of failed detumescence (OR 1.35, 95% CI 1.13–1.62; $p < 0.001$) and a 27% increase in the odds of operative management (OR 1.27, 95% CI 1.09–1.48; $p = 0.002$). When expressed over a 12-hour interval, the corresponding increases were 83% for failed detumescence (OR 1.83, 95% CI 1.28–2.61; $p < 0.001$) and 61% for operative management (OR 1.61, 95% CI 1.19–2.18; $p = 0.002$). Presentation delay was not independently associated with readmission.

Consistent with these findings, presentation time demonstrated good discrimination for failed detumescence (AUC 0.828, 95% CI 0.721–0.935) and operative management (AUC 0.794, 95% CI 0.669–0.919). The optimal ROC classification was ≥ 28 hours, with 70.8% sensitivity and 84.6% specificity for failed detumescence and 73.7% sensitivity and 79.5% specificity for operative management. The 24-hour threshold was clinically selected, while the ≥ 28-hour threshold was identified from the ROC analysis and should be considered exploratory.

Discussion

This study demonstrates a strong time-dependent association between presentation delay and failure of non-operative management in IP. Patients presenting later were more likely to fail initial non-operative measures of aspiration and phenylephrine administration and were more likely to require operative intervention. Importantly, this association is maintained when data is analysed continuously, as well as when a clinically selected 24-hour threshold is applied, suggesting that treatment failure is a progressive effect of ischemic duration rather than an artefact of dichotomisation.

These findings are consistent with contemporary series.

In a cohort of 169 IP encounters, patients requiring surgical intervention presented substantially later than those managed without surgery (median 36 versus 10 hours). Priapism duration was independently associated with shunt placement, with an odds ratio of 1.05 for each additional hour, while a 24-hour threshold identified shunt requirement with 77% sensitivity and 90% specificity.[5] Similarly, in the present cohort, patients requiring operative management presented at a median of 48 hours compared with 12 hours among those managed non-operatively, with the odds of operative intervention increasing by 27% for every 6-hour delay. Presentation duration also demonstrated comparable discrimination for operative management, with an AUC of 0.794 in the present study and 0.83 in the larger published cohort.[5] Other retrospective evidence has identified presentation duration as a strong predictor of corporoglandular shunting, with an AUC of 0.90 and a 27-fold increase in the likelihood of shunting after 15.5 hours.[6] A

substantially shorter duration has also been reported among patients achieving resolution with phenylephrine than among non-responders (8.8 versus 57.3 hours).[7] Collectively, these findings strengthen the association between delayed presentation, non-operative treatment failure and operative intervention, despite differences in study populations and institutional practice.

Published outcomes following intracavernosal phenylephrine provide further support for this time-dependent relationship. Non-operative resolution has been reported in 63.9% of 97 patients receiving phenylephrine, with a substantially shorter mean duration among responders than non-responders (8.8 versus 57.3 hours).[7] Higher resolution rates have been described in cohorts presenting earlier, including successful non-operative treatment of all episodes presenting within 36 hours[8] and detumescence in 91% of encounters in a cohort with a median presentation duration of 5.4 hours.[9] Differences in presentation duration, aetiology, phenylephrine dose, treatment protocol and outcome definitions may therefore account for variation in reported treatment success.

The association between ischaemic duration and treatment failure has a plausible pathophysiological basis. Prolonged veno-occlusion results in progressive corporal hypoxia, acidosis and glucopenia, subsequently impairing cavernosal smooth muscle contraction.[10] Experimental evidence indicates that sustained anoxia abolishes tonic contractile responses to phenylephrine, while human ultrastructural studies demonstrate substantial smooth-muscle injury and marked necrosis after approximately 24 hours of ischaemia.[3][10] Translational evidence also demonstrates absent cavernosal smooth-muscle contraction in response to high-dose phenylephrine in tissue specimens obtained from patients with prolonged ischaemic priapism that was initially refractory to standard-dose phenylephrine.[4] Overall, these findings are consistent with progressive treatment failure seen in delayed IP cases in our cohort, as it could reflect loss of functional corporal muscle, with progressively reduced responsiveness to alpha adrenergic agonists as the duration of ischaemia increases.

The study has several limitations. Its retrospective, single-centre design creates a risk of selection bias and limits generalisability. The symptom duration depends on clinical documentation and patient recall, hence potentially affecting precision of onset time. Furthermore treatment was not standardised across clinicians, hence differences in aspiration techniques, phenylephrine doses, and the decision to proceed to theatre may have influenced outcomes. Some patients contributed to more than one episode. Episodes from the same patient may be more similar than episodes from different patients. Given the analysis didn't account for this, it may represent each encounter as not being statistically independent. Therefore, the precision of the reported associations may be overestimated. In our binary regression analysis, we only accounted for previous priapism. However, other confounding factors such as age, comorbidities, etiology and respective treatment may have influenced these findings. The relatively small number of outcomes reduces the precision of some of these estimates made.

The clinically selected 24-hour threshold may assist with considering earlier senior involvement and preparations for operative management. However, it should not be interpreted that aspiration and intracavernosal phenylephrine have no role. In our study, 6 of 23 episodes presenting after 24 hours still

achieved non-operative detumescence with 25% of these episodes lasting more than 48 hours. Furthermore, current guidelines do not define a single duration in which operative management should be automatically attempted over medical management. The exploratory 28-hour cut off identified using the Youden's index was comparable to our chosen 24- hour cut off. However, given it was developed with a relatively small cohort, we recommend studies on an independent population before clinical application.

Despite these limitations, the study demonstrates a consistent association between presentation duration and acute treatment outcomes across categorical comparisons, continuous regression models, and ROC analysis. The findings support prompt treatment, while providing locally relevant estimates that may assist in patient counselling and the need for operative intervention.

Increasing duration of IP at presentation was strongly associated with failure of non-operative detumescence and the need for operative management. Episodes presenting within 24 hours had substantially higher rates of successful detumescence and lower rates of operative intervention than those presenting later. Presentation duration also showed good discrimination for both outcomes when analysed continuously. The 24-hour threshold may therefore provide a practical marker for counselling patients, involving senior clinicians and preparing for possible operative management. It should not, however, be regarded as an absolute point beyond which non-operative treatment is futile. The exploratory 28-hour threshold requires validation in a larger independent cohort before it can inform clinical decision-making.

Declarations

Author Contribution Statement

Neehar Shetty contributed to the study conception, data collection, manuscript drafting, critical revision and approval of the final manuscript. Immad Amanulla contributed to manuscript drafting, critical revision and approval of the final manuscript. Mohamed Mubarak contributed to the study conception, statistical analysis and critical revision of the manuscript and approval of the final manuscript. Anthony Emmanuel contributed to the study conception, critical revision and approval of the final manuscript.

Ethical Approval

This retrospective clinical audit was registered with and approved by the Newcastle upon Tyne Hospitals NHS Foundation Trust Audit Department (registration number 5247). The audit used routinely collected, anonymised clinical data, and no identifiable patient information was accessed or reported. Formal research ethics committee approval and individual informed consent were not required for this clinical audit. No identifiable patient information was accessed or reported.

Competing Interests

The authors declare no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Acknowledgements

The authors have no acknowledgements.

Data Availability Statement

The anonymised data analysed during this study are available from the corresponding author on reasonable request, subject to local information-governance approval.

References

1. European Association of Urology. EAU Guidelines on Sexual and Reproductive Health: Priapism. https://uroweb.org/guidelines/sexual-and-reproductive-health/chapter/priapism. Accessed 13 Sep 2026.
2. Bivalacqua TJ, Allen BK, Brock G, Broderick GA, Kohler TS, Mulhall JP, et al. Acute ischemic priapism: an AUA/SMSNA guideline. J Urol. 2021;206:1114–1121. https://doi.org/10.1097/JU.0000000000002236.
3. Spycher MA, Hauri D. The ultrastructure of the erectile tissue in priapism. J Urol. 1986;135:142–147. https://doi.org/10.1016/S0022-5347(17)45549-2.
4. Muneer A, Minhas S, Freeman A, Kumar P, Ralph DJ. Investigating the effects of high-dose phenylephrine in the management of prolonged ischaemic priapism. J Sex Med. 2008;5:2152–2159. https://doi.org/10.1111/j.1743-6109.2008.00862.x.
5. Zhao H, Dallas K, Masterson J, Lo E, Houman J, Berdahl C, et al. Risk factors for surgical shunting in a large cohort with ischemic priapism. J Sex Med. 2020;17:2472–2477. https://doi.org/10.1016/j.jsxm.2020.09.007.
6. Palka J, DuComb W, Begun E, Soto-Aviles O. Factors associated with corporoglandular shunting for patients with first-time ischemic priapism. Urology. 2021;154:191–195. https://doi.org/10.1016/j.urology.2021.03.030.
7. Scarberry K, Deebel NA, Dutta R, Matz E, Terlecki RP. Safety and efficacy of phenylephrine administration of ischemic priapism: an opportunity for quality improvement in periprocedural

safety assessment. Urology. 2022;169:115–119. https://doi.org/10.1016/j.urology.2022.08.011.

8. Ridyard DG, Phillips EA, Vincent W, Munarriz R. Use of high-dose phenylephrine in the treatment of ischemic priapism: five-year experience at a single institution. J Sex Med. 2016;13:1704–1707. https://doi.org/10.1016/j.jsxm.2016.09.010.
9. Sidhu AS, Wayne GF, Kim BJ, Anderson AGS, Cordon BH, Caso JR, et al. The hemodynamic effects of intracavernosal phenylephrine for the treatment of ischemic priapism. J Sex Med. 2018;15:990–996. https://doi.org/10.1016/j.jsxm.2018.05.012.
10. Broderick GA, Gordon D, Hypolite J, Levin RM. Anoxia and corporal smooth muscle dysfunction: a model for ischemic priapism. J Urol. 1994;151:259–262. https://doi.org/10.1016/S0022-5347(17)34928-5.

Figures

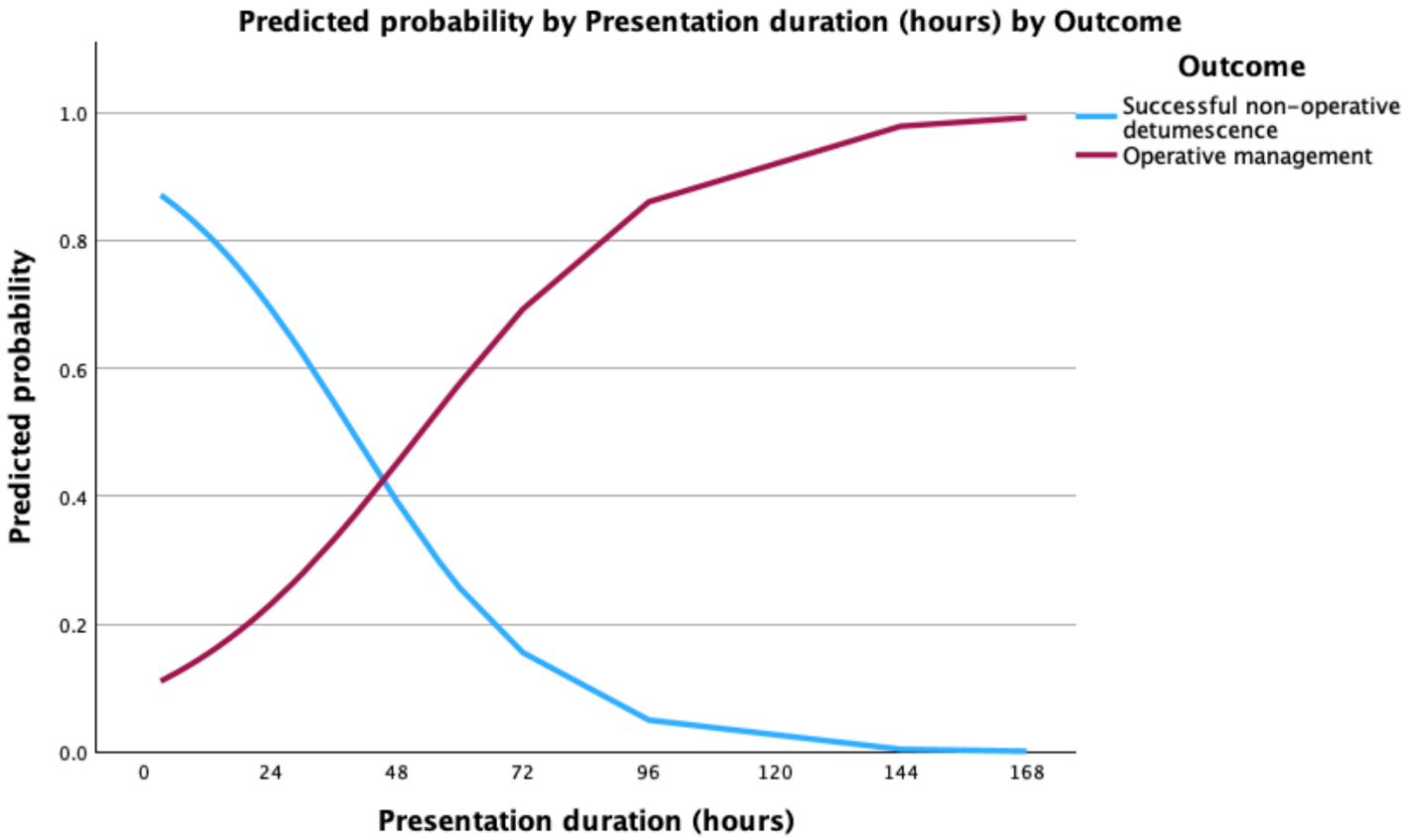


Figure 1

Predicted probability of successful detumescence and operative management according to priapism duration at presentation.

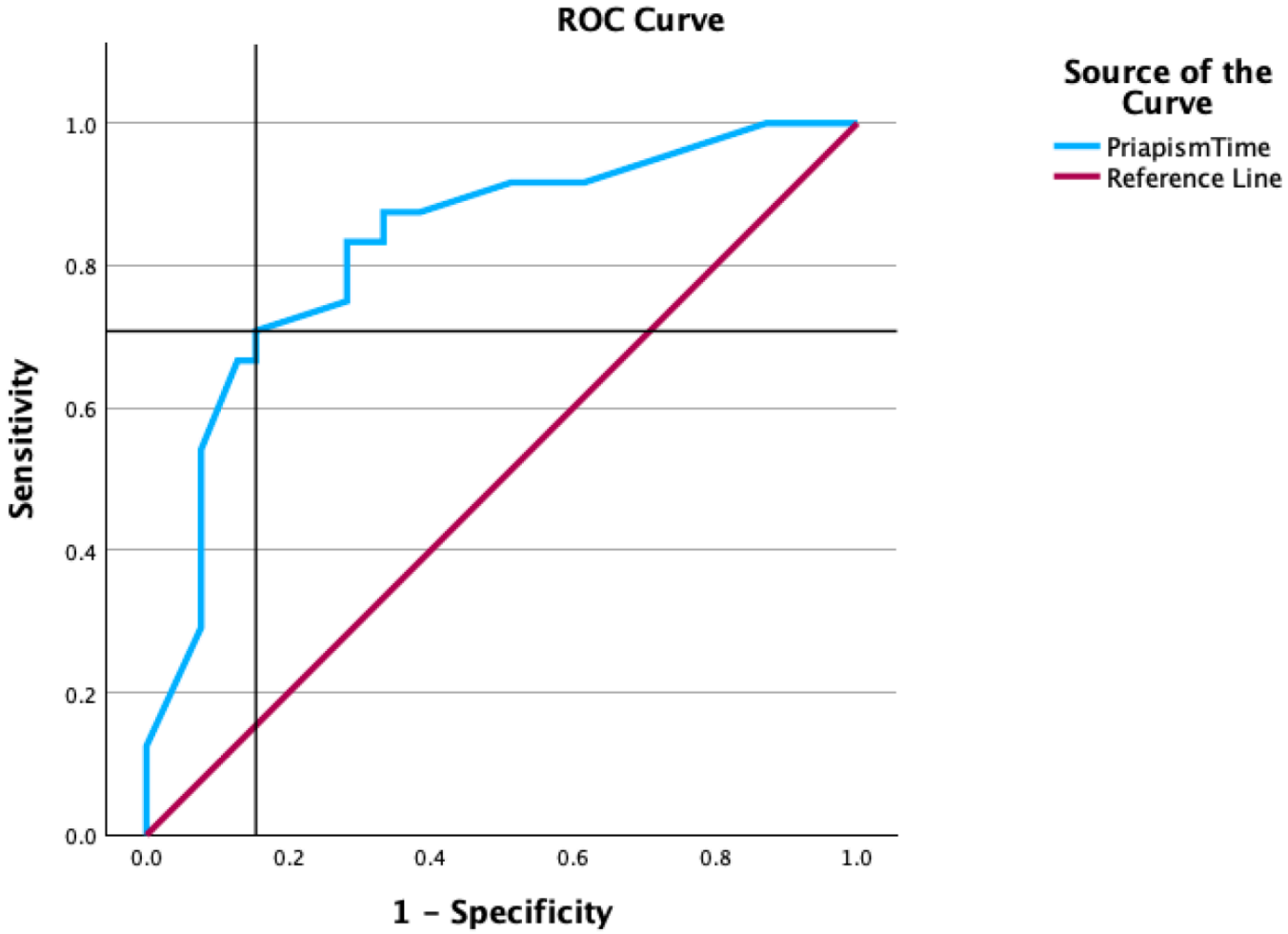


Figure 2

ROC curve of presentation time for predicting failed detumescence. Presentation time demonstrated good discrimination for failed detumescence (AUC 0.828, 95% CI 0.721–0.935). A threshold of ≥28 hours identified failed detumescence with 70.8% sensitivity and 84.6% specificity

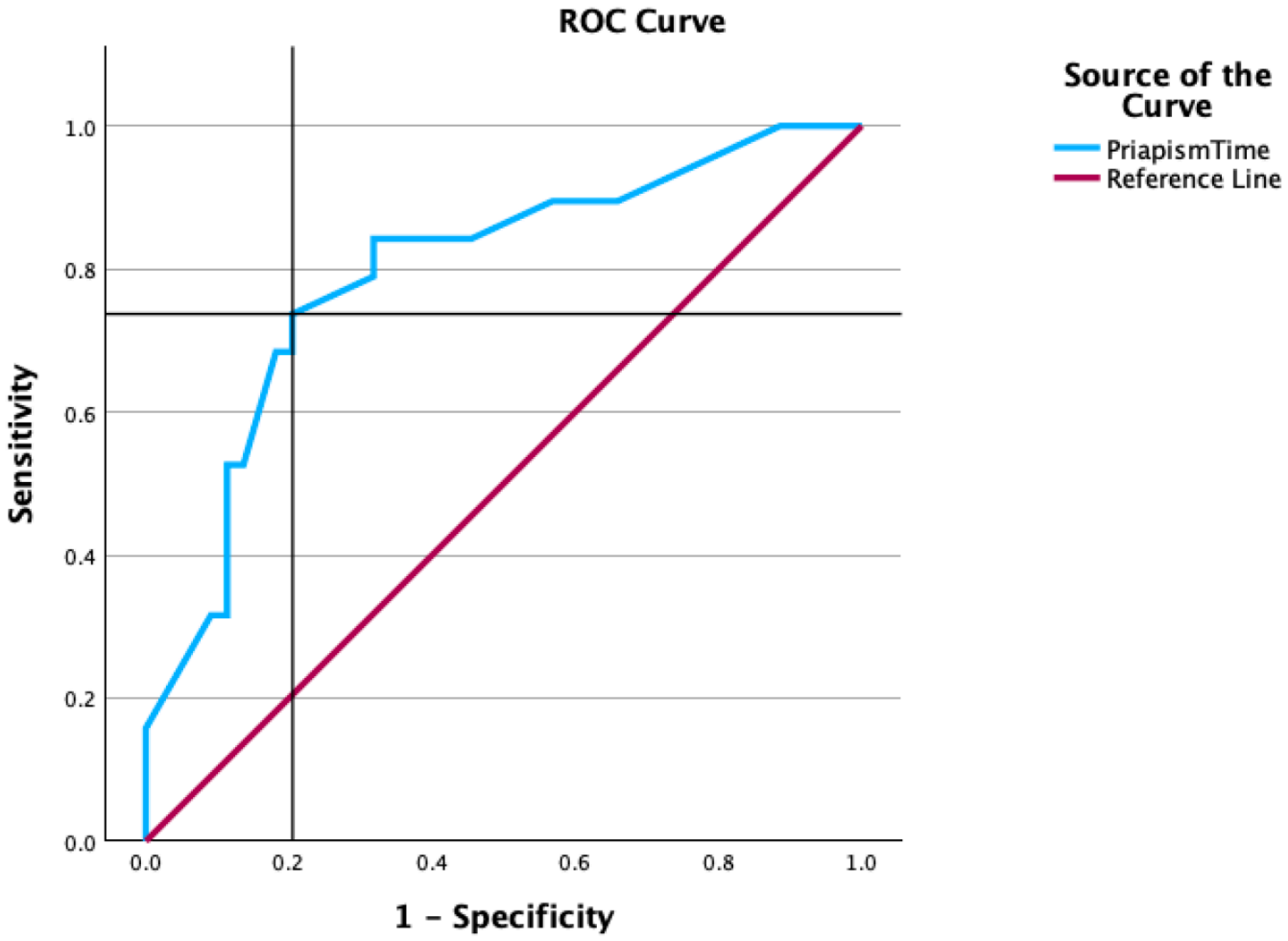


Figure 3

ROC curve of presentation time for predicting operative management. Presentation time demonstrated good discrimination for operative management (AUC 0.794, 95% CI 0.669–0.919). Presentation at or after 28 hours provided 73.7% sensitivity and 79.5% specificity.