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REVIEW

Penile Prosthesis Implantation in Refractory Ischaemic Priapism: Patient Selection and Special Considerations

Marco Capece[1]
Marco Falcone[2]
Tommaso Cai[3]
Alessandro Palmieri[1]
Andrea Cocci[4]
Roberto La Rocca[1]

[1]Department of Urology, AOU Federico II, University Hospital, Naples, Italy; [2]Department of Neurourology, A.O.U. Città della Salute e della Scienza di Torino - Unità Spinale Unipolare, Turin, Italy; [3]Ospedale Santa Chiara, Trento, Italy; [4]Department of Oncologic, Minimally-Invasive Urology and Andrology, Careggi Hospital, University of Florence, Florence, Italy

Abstract: Ischemic priapism accounts for more than 95% of all priapic episodes. It has to be considered a urological emergency because its time extension may lead to necrosis of smooth muscle cells of the corpora cavernosa, resulting in a complete erectile dysfunction, penile shortening and loss of girth. In the present systematic review, we perform an up-to-date literature search for patients suffering from refractory ischemic priapism who undergo penile prosthesis implantation with particular interests to the patients characteristics. The conservative management of the priapic episode consists of a sympathomimetic agent in the first istance. Failure or recurrence of priapism following these conservative measures is an indication for surgical management. Shunt procedures between the corpora cavernosa and the neighbouring structures are often used first line; however, in refractory ischemic priapism the success rate is minimal. In such cases (>48 h) an indication of immediate placement of a penile prosthesis could be the best solution.

Keywords: refractory ischemic priapism, erectile dysfunction, priapism, penile prosthesis

Introduction

Ischemic priapism is a rare condition that has an incidence of 1–1.5 cases every 100.000 people.[1] The pathological mechanism of this condition is due to the obstruction of penile venous outflow, which causes a hypoxic blood stasis within the corpus cavernosum leading to a peculiar compartment syndrome.[2–4] If the blood stagnation remains for more than 24 hours, smooth muscle cell (SMC) necrosis begins and the risk of developing a refractory erectile dysfunction is more than 90%.[5] After 48–72 hours there are zero chances of recovering erectile dysfunction.[6]

Once the diagnosis of ischemic priapism is confirmed an initial conservative management is usually attempted. This consists of physical exercise, cold shower or ejaculation, in order to facilitate the SMC contraction. After these attempts, transglandular corporal irrigation followed by instillation of α-agonists represent the most beneficial option, being determinant in more than 36% of cases.[1,2] Unfortunately, the remaining part of the patients do not respond to α-agonists either. At this stage, the smooth muscle damage has already occurred. Surely shunt surgery is more effective, however it can only solve the priapic episode leaving the issue of erectile dysfunction.[7] The Winter shunt is the most common procedure, and its aim is to create a fistula between the spongiosa and the corpora cavernosa, in order to literally "shunt" the blood in a different venous system. On

Correspondence: Alessandro Palmieri
Department of Neuroscience, Reproductive Science and Odontostomatology, University Federico II of Naples, via S.Pansini 5, Naples, 80131, Italy
Tel +39 081 746 2611
Fax +39 081 746 4311
Email androfedii@gmail.com

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the other hand, this fistula may result in a refractory erectile dysfunction. In addition to that, the inevitable fibrosis of the corpora cavernosa causes a certain degree of shortening of the penis which worsen the already compromised situation.[6,8] Thus, in such cases the implantation of a penile prosthesis may represents the only solution either to solve the priapism and to restore the erectile function and to minimize the shortening of the penis.

The surgical procedure of penile prosthesis implantation (PPI) can be seriously challenging due to the diffuse corporal fibrosis and the later patient undergoes surgery the more difficult the implant becomes.[9] PPI can be performed either in the "early" phase of the refractory ischemic priapism (RIP), or at a later stage when refractory erectile dysfunction and penile shortening have already occurred.

In the present review, the authors evaluate the up-to-date literature and will focus on the characteristics of patients undergoing penile prosthesis implantation after RIP and the type of device used.

Materials and Methods

Search

A systematic search has been performed using the terms "ischemic priapism", "refractory erectile dysfunction", "fibrosis", "penile implant", "immediate implantation", "delayed implantation" using Pubmed and EMBASE search engines. The systematic review has not been registered on PROSPERO as "PROSPERO does not currently accept registrations for scoping reviews, literature reviews or mapping reviews". Search criteria only includes English-language studies, published from 1990 to 2021.

Study Selection

Data extraction was performed by three authors (M.C, M. F., A.C) and subsequently cross-checked. The conflicts have been sorted according to the "two out of three rule". Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram is reported in Figure 1. The search has produced 9 retrospective studies: 6 single-center case series, 3 case reports. No prospective, multicentric or randomized trials have ever been published.

Results

Nine studies have been included in the analysis and the reports are listed in Table 1. The number of patients included in the studies are 102, and biggest case-series consists of 50 patients.[8] Mean age of patients undergoing penile prosthesis implantation after an episode of RIP varies from 19 to 73 years old with a peak-incidence age between the 40s and 50s.[8,11,13–15,17] Regarding the etiology, 43 patients (41.2%) suffered from idiopathic RIP, 23 patients (22.5%) drug-induced, 16 patients (15.6%) had hematological conditions (15 sickle cell disease, 1 case of thalassemia), 14 patients (13.7%) self-administered intracavernosal injection (ICI) and the remaining 6 patients (5.8%) suffered from less frequent conditions such as prostate cancer and epilepsy.

Only two case reports show the ethnicity of the patients and in both cases they are African-American.[10–12] None of the retrospective study analyses this parameter.[8,11,13–17]

In 8 studies, the duration of priapism ranges from 24 to 720 hours.[8,12–17] In one case-report the authors do not cite the length of the priapic episode.[11]

Eighty-eight patients (86.2%) underwent malleable penile prosthesis (MPP) whereas 14 patients (13.8%) received an inflatable penile prosthesis (IPP). In 2002 Rees et al published a case-series of 8 patients with RIP, two of them underwent an IPP. One of the two patients developed a curvature of the penis at the maximum inflation of the device after 6 weeks from surgery. Seven years later Ralph et al reported 50 patients who underwent penile prosthesis implantation broken down as follows: 43 MPP and 7 IPP. The authors report an infection rate of 6% and an erosion rate of 6% in MPP group, whereas 1 auto-inflation and 1 curvature have been recorded in IPP group. In 2010 the group of Salem et al published a case-series of 12 RIP patients who were implanted with MPP and none of them developed long-term complication. One year later Sedigh et al described the first case-series in which most of the patients received an IPP rather than MPP (4 out of 5) and none of them developed a penile deformity afterwards. The newest retrospective analysis has been conducted by Zacharakis et al who compared 2 subgroups of 5 patients who underwent a MPP with or without a T-shunt procedure plus corporeal biopsy. No infections or erosions have been recorded in both groups.

Discussion

Ischemic priapism is considered a rare entity, which is usually conservatively treated with aspiration or injection of phenylephrine.[18] When the latter fails we are a facing a RIP, and a caverno-glandular shunt procedure should be attempted if the priapism duration is less than 24 hours or whether there are no signs of smooth muscle necrosis

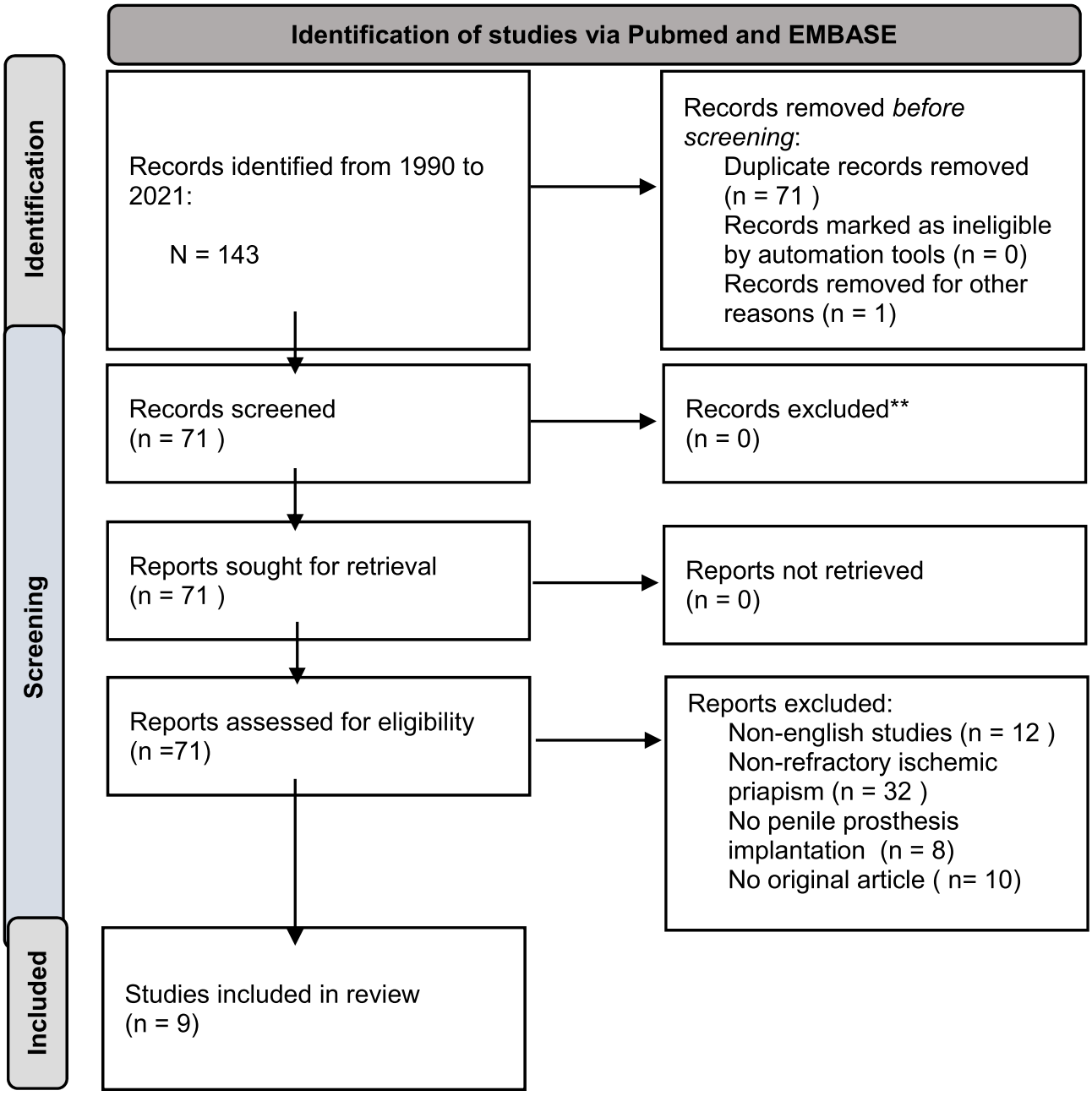

Figure 1 PRISMA flow-chart.
Notes: Adapted from Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *J Clin Epidemiol*. 2021;134:178–189. Creative Commons license and disclaimer available from: https://creativecommons.org/licenses/by/4.0/.[19]

demonstrated with a magnetic resonance (MRI).[8] Indeed, there is a window of time between 24 and 48 hours where the smooth muscle cell necrosis degree may not be quantifiable, and in some cases the insertion of a penile prosthesis in the first instance may represent an overtreatment. On the other hand, in this time frame not all the hospitals may guarantee the implementation of a urgent MRI of the penis, leaving the decision of the following step to the clinician. It is known that after 24 to 48 hours of priapism there is a widespread cavernous endothelial destruction and SMC necrosis becomes conspicuous, although no clots are usually found.[5] When the priapic episode lasts more than 48 hours, clots formation begins and most of the SMC either undergo necrosis or turn into fibroblasts-like cells. At this stage, the chances of recovering erectile function are nullified, thus a penile prosthesis implantation represents the only treatment option.

Table 1 Studies Focusing on Penile Prosthesis Implantation After Refractory Ischemic Priapism

Study	Design	Patients (n)	Etiology of RIP	Age (Years)	Ethnicity	Duration of Priapism (Hours)	Implant
Upadhyay et al,[10] 1998	CR	1	SCD	19	African-American	N/A	IPP
Rees et al,[11] 2002	RS	8	3 Idiopathic 1SCD, 3 ICI, 1 Psychotropic drug	Mean 41 (Range 27–58)	N/A	Median 91 (range 32–192)	2 IPP, 6 MPP
Tausch et al,[12] 2007	CR	1	SCD	68	African-American	26	MPP
Ralph et al,[8] 2009	RS	50	24 idiopathic, 6 antidepressants, 5 SCD, 4 PDE5i, 4 ICI, 2 recreational drugs, 2 α-blockers, 1 epilepsy, 1 β-thalassemia, 1 prostate cancer	Mean 46 (Range 25–73)	N/A	Median 209 (Range 24–720)	43 MPP, 7 IPP
Salem and El Aasser,[13] 2010	RS	12	6 ICI, 4 idiopathic, 1 SCD, 1 PDE5i	Mean 43 (Range 28–56)	N/A	Median 120 (Range 60–168)	12 MPP
Sedigh et al,[14] 2011	RS	5	NA	Mean 52 (Range 33–73)	N/A	Median 41 (Range 25–72)	1 MPP, 4 IPP
Faddan et al,[15] 2015	CR	1	Idiopathic	53	N/A	29	MPP
Tausch et al,[16] 2015	RS	14	4 SCD, 3 drug-induced, 7 idiopathic	N/A	N/A	Mean 82	14 MPP
Zacharakis et al,[17] 2015	RS	10	4 idiopathic, 3 drug-induced (trazodone), 2 SCD, 1 ICI	Mean 41.3 (Range 26–58)	N/A	Median 188 (Range 98–336)	10 MPP

Abbreviations: CR, Case Report; RS, Retrospective Study; SCD, Sickle Cell Disease; ICI, Intracavernosal injection; MPP, Malleable Penile Prosthesis; IPP, Inflatable Penile Prosthesis.

The aim of the present paper is to analyze the characteristics of patients undergoing penile prosthesis implantation after RIP. After a detailed search of the literature only nine papers have been included in this review for a total number of 102 patients. Clearly, the number is so limited that represents a serious limitation for the conclusion the authors may reach.

Firstly, we have analyzed the age of these patients, and despite a wide range varying from 19 to 73 years old, the peak of incidence is between 40s and 50s. This means that, although its rarity, RIP cannot be underestimated as it affects people in the midst of the sexual maturity, whose consequences might be devastating. Thus, in such subset of patients an immediate penile prosthesis implantation may likely represent the best option. In fact, all studies have highlighted the superiority of immediate versus delayed implantation, although none of them was designed to compare these two groups.

Secondly, it is interesting to know that only 40% of RIP are idiopathic, whereas the majority of the cases happens because of drugs intake (PDE5is, antidepressants, α-blockers), ICIs or hematological conditions. This certainly should be highlighted to the clinicians who prescribe these drugs, as more awareness of this condition may be the first step to reduce the damages it can cause.

Interestingly, only two case reports have declared the ethnicity of the patients, whereas the other studies do not mention such parameter. Strikingly, none of the studies have reported patients' characteristics such as previous erectile function, previous regular use of phosphodiesterase type 5 inhibitor (other than the cause itself), comorbidities (other than the cause itself), social and psychological status, sexual behavior or any other information. Clearly, these aspects need to be evaluated in such complex cases because the decision of the following step should take into consideration the previous status and cannot exclude the patients will.

At the present time, having analyzed the whole literature, the best option in cases of RIP seems to be the "early" insertion of a penile prosthesis, as it solves the priapic episode avoiding penile shortening and much more complex delayed implantation which results in higher dissatisfaction rate for these patients.[8]

Regarding the type of device to implant, most of the authors suggest MPP because of the SMC death and significant post-operative scarring. Using an IPP in the first instance increases to the risk of scarring around a deflated cylinder, leading to a certain degree of contracture and deformity. Only one author suggested the implantation of IPP without deflation for 4 weeks in order to prevent such complication. On the other hand, keeping the IPP inflated for such long time could weaken the apex of the corpora cavernosa leading to the same erosion a MPP could cause, however the numbers are very limited and a final conclusion cannot be drawn.

Conclusion

This systematic review highlights the scarcity of literature data. None of the studies report characteristics of patients suffering from RIP. To date there are no trials demonstrating the superiority of immediate versus delayed penile prosthesis implantation, because none of the studies was designed with this purpose. However, despite a merely speculative conclusion, most of the authors are in favor of the early implantation since it has a lower complication rate and implicates an easier procedure. Considering the reduced complication rate and the ease of the procedure, all studies are in favor of early implantation over delayed implantation.

Abbreviations

IPP, inflatable penile prosthesis; MPP, malleable penile prosthesis; RIP, refractory ischaemic priapism.

Disclosure

The authors report no conflicts of interest in this work.

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