

Penile Revascularisation for Vascular Impotence

L P K Ang, P H C Lim

ABSTRACT

Objective: Many methods of microscopic penile revascularisation procedures have been employed over the past 2 decades for the treatment of vasculogenic impotence, with varying success rates. The aim of our study was to evaluate the effectiveness and complications of deep dorsal vein arterialisation in the treatment of selected patients with arteriogenic and mixed arteriogenic/venogenic impotence.

Methods: This involved a retrospective analysis of 6 patients with vasculogenic impotence who presented to Toa Payoh Hospital from December 1991 to November 1994 and had penile revascularisation surgery performed. All patients underwent an extensive preoperative assessment, including dynamic infusion cavernosometry and cavernosography and selective pudendal arteriography.

Results: The 6 patients were aged between 27 and 51 years (mean 44 years). 2(33%) patients had pure arteriogenic impotence, while 4(66%) had mixed arteriogenic and venogenic impotence. Two patients (33%) had excellent surgical outcomes and 2 patients (33%) were considered improved. The mean follow-up period was 19.8 months (range 8 to 37). Complications were minimal.

Conclusions: We conclude that although the results of penile revascularisation are promising in carefully selected patients, further studies with longer follow-up and more objective post-operative tests of hemodynamic and erectile function are needed to assess the true value of this mode of treatment.

Keywords: penile revascularisation, arteriogenic, venogenic, impotence

INTRODUCTION

Microsurgical penile revascularisation has been shown to be an effective form of therapy in properly selected patients with vasculogenic impotence. Vasculogenic impotence may result from dysfunction or disease of the arterial inflow vessels, the venous outflow vessels, the corporal sinusoidal tissue or any combination of these. Improved surgical outcomes during the last decade have resulted from a combination of factors, including refinements in surgical procedures designed to increase intracorporeal blood flow as well as an improved understanding of vasculogenic impotence.

Treatment of pure arteriogenic impotence may be attempted by neoarterialisation procedures or by procedures that arterialise the dorsal penile vein system. Using an end-to-side anastomosis of the inferior epigastric artery to the dorsal penile artery (Michal II procedure) Michal et al⁽¹⁾ obtained a 60% success rate.

Dorsal vein arterialisation procedures are usually used for patients with mixed arteriogenic and venogenic pathophysiology. Some investigators use dorsal vein arterialisation for patients with pure arteriogenic impotence, especially if there is diffuse arteriosclerotic pathology that cannot be bypassed by arterioarterial anastomosis. This procedure has also been used for pure venogenic impotence, though a penile vein resection/ligation operation alone is a more logical approach to this problem.

Several dorsal penile vein arterialisation procedures have been developed by Virag^(2,3). The most commonly performed of these procedures are the Virag 2 and Virag 5. In the Virag 2, the inferior epigastric artery is anastomosed to the deep dorsal vein without creation of a venocavernous shunt. The deep dorsal vein is ligated proximally and may be ligated distally depending on the pulsation in the glans following release of the clamps. The Virag 5 operation is identical, but in addition, a venocavernous shunt is created. Furlow and Fisher⁽⁴⁾ suggested a modification in which there was no creation of a venocavernous shunt and the emissary veins were preserved to carry the arterial flow to the cavernous bodies.

We report our experience of penile revascularisation in 6 patients with arterial or mixed (venous and arterial) disease.

PATIENTS AND METHODS

Patient Selection

From June 1991 to May 1995, 6 patients underwent microsurgical penile revascularisation with or without a combined procedure to correct cavernosal venous leakage. The 6 patients were aged between 27 and 51 years (mean 44 years) and had erectile dysfunction secondary to arterial insufficiency or a combination of venous and arterial disease.

In the selection of patients with vasculogenic impotence who were likely to benefit from revascularisation procedures, the evaluation of penile blood flow was essential. Non-vascular causes o-

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impotence were excluded in these patients. The assessment included a complete history, physical and neurological examination and a psychological evaluation. Attention was given to the presence or absence of nocturnal and early morning erections, firmness of the erect penis, ability for coitus, presence of cardiovascular risk factors and diabetes as well as current medications. Those patients suspected to have psychological aberrations were evaluated by nocturnal penile tumescence studies and psychiatric consultation. Blood sugar levels and urinalysis were performed. Hormonal abnormalities were excluded by obtaining serum testosterone, prolactin and luteinising hormone levels.

Stimulation of erection by intracavernous injection of vasoactive drugs (eg papaverine or prostaglandin E1) was a useful diagnostic screening method for vasculogenic impotence, either arteriogenic or venogenic. Inadequate response to large doses of intracavernous vasoactive agents suggested that there was an arterial or corporovenous insufficiency. Additional studies were subsequently performed to support the diagnosis of vasculogenic impotence. These included dynamic infusion cavernosography and cavernosometry and selective pudendal arteriography. Dynamic infusion cavernosography and cavernosometry helped to confirm the presence of venous leakage. Selective pudendal arteriography was reserved for patients in whom penile revascularisation surgery was contemplated. Arteriography was performed after the intracavernous injection of papaverine; this provided us with good visualisation of the cavernous arteries and assessment of their

functional status. Those with diffuse arterial disease and obstruction distal to the common penile artery were not considered as surgical candidates for the operation.

To be considered a candidate for any form of penile vascular surgery, a patient should have an abnormal response to intracavernous pharmacodiagnosis, as well as abnormal duplex sonography of the corpus cavernosum, dynamic infusion cavernosometry and penile arteriography.

All the 6 patients with arterial or mixed(venous and arterial) disease underwent dorsal vein arterialisation. At the time of surgery, other venous channels demonstrated on pre-operative dynamic infusion cavernosography and cavernosometry in patients with corporal venous leakage were also dissected and ligated.

Surgical Technique

A paramedian incision was made along the lateral border of the rectus muscle beginning from just below the umbilicus to the base of the penis. The lateral border of the rectus muscle was mobilised and the inferior epigastric pedicle(both artery and vein) was carefully dissected. The collaterals were ligated with 4-0 silk. Between 15 and 20 cm of vessel was mobilised, measuring the distance necessary to reach the deep dorsal vein. The artery was brought out through a subcutaneous tunnel to the root of the penis. The artery was not transected until the dorsal vein dissection was completed.

A suprapubic incision was made at the base of the penis. The small dorsal superficial veins were not ligated. Buck's fascia was incised longitudinally on the deep dorsal vein. Care was taken to preserve the dorsal arteries and nerves. A length of approximately 3 to 4 cm of the deep dorsal vein was dissected and the perforating veins were tied.

A modified Furlow-Fisher procedure was performed. This involved preservation of circumflex collaterals and the destruction of deep dorsal venous valves by a stripper. Four to 6 emissary veins were identified and preserved. The artery was spatulated and sutured end-to-side to the dorsal vein with 8/0 nylon running sutures using microscopic magnification. In 1 patient, an end-to-end anastomosis was made after transection of the dorsal vein. Heparin solution was used in the artery and vein during the anastomosis, but the patient was not systemically heparinised. When hemostasis was well controlled, an observation period of 5 to 10 minutes was used to make sure that there was no hypervascularity of the glans (Fig 1).

Assessment of post-operative results included historical information, nocturnal tumescence study, doppler flow studies and a comparison of pre-operative and post-operative pharmacologic erections induced by intracavernosal vasoactive agents. Arteriography was repeated in selected patients.

The outcome of surgery was considered excellent if there was return of unaided, satisfactory and

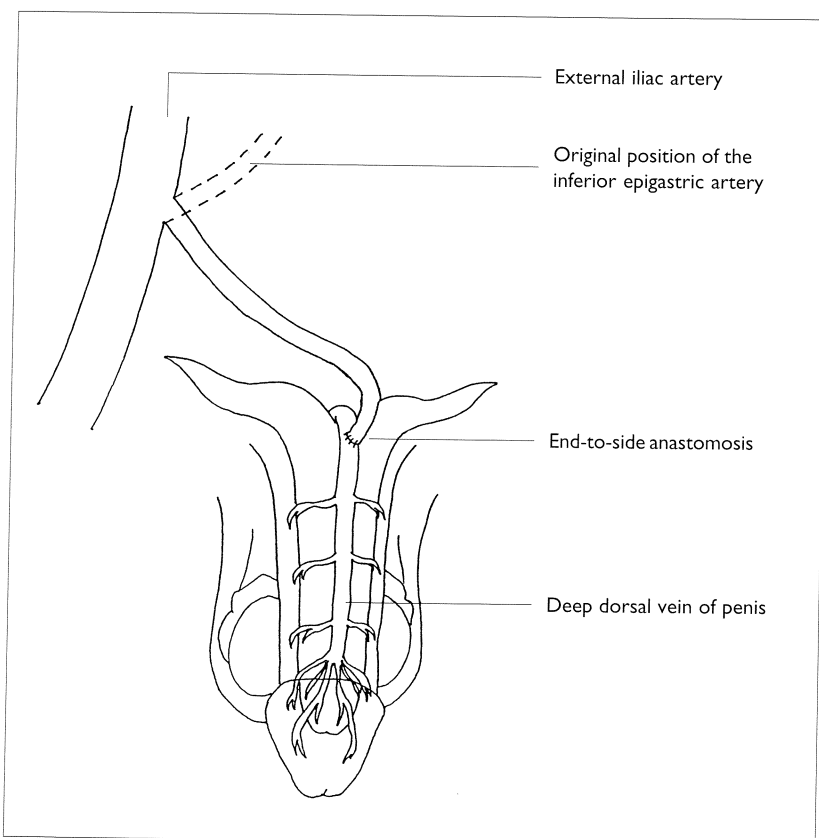


Fig 1 - Schematic representation of the penile revascularisation procedure involving an end-to-side anastomosis of the inferior epigastric artery to the deep dorsal vein of the penis

Table I - Aetiology/risk factors and surgical outcomes

Patient No.	Age(years)	Aetiology/risk factors	Surgical outcomes
1	51	Hyperlipidemia	Excellent
2	43	Diabetes mellitus & hypertension	Failed
3	27	Blunt perineal/pelvic trauma	Improved
4	46	Blunt perineal/pelvic trauma	Failed
5	46	No identifiable risks	Excellent
6	49	No identifiable risks	Improved

successful intercourse and as improved, if he was able to have successful intercourse with the aid of pharmacological intracavernosal injection therapy which was not possible pre-operatively. Patients were considered surgical failures if there was no improvement in the quality of erections from the pre-operative state.

RESULTS

The 6 patients who underwent penile revascularisation were aged between 27 and 51 years (mean 44 years). Two patients had a history of blunt perineal/pelvic trauma, 1 had diabetes and hypertension, 1 had hyperlipidemia and 2 had no identifiable risk factors (Table I). All patients had a normal hormonal profile. Two patients (33%) had pure arteriogenic impotence, while 4(66%) patients showed pre-operative evidence of both corporeal venous leakage, demonstrated on dynamic infusion cavernosography and cavernosometry and arterial insufficiency.

The mean post-operative follow-up period was 19.8 months (range 8 to 37). Two patients(33%) were considered to have an excellent surgical outcome, 2(33%) improved, and 2(33%) failed (Fig 2). The success rate, taken as those with excellent or improved outcomes, was 66%. Of the two patients who failed, the first was a 46-year-old man who suffered pelvic trauma with injury to the left internal pudendal artery following a road traffic accident. Cavernosometry and arteriography performed post-operatively demonstrated significant cavernous venous leakage as well as anastomotic graft occlusion. The second patient was a 43-year-old man who had a history of diabetes mellitus and hypertension. There was no statistically significant difference in the surgical outcomes when patients were analysed with respect to age or length of follow-up($p>0.05$).

Complications of the procedure were minimal. This included two cases of penile skin oedema which subsided spontaneously within a week, two cases of prolonged penile pain and one case of wound dehiscence. No post-operative glans hypervascularity, penile shortening or penile numbness were noted.

DISCUSSION

Various techniques of penile revascularisation have been used in the treatment of properly selected patients with vasculogenic impotence. An improved understanding of the pathophysiology of vasculogenic impotence, improved methods for vascular assessment and refinements in microsurgical techniques have improved the surgical outlook of patients over the last decade. The early technique of cavernous body revascularisation involving direct anastomosis of the inferior epigastric artery to the corpus cavernosum(the Michal I operation) has been abandoned because priapism and early shunt-thrombosis occurred in the majority of patients⁽⁵⁾. Subsequently, the Michal II operation was developed, which involved an end-to-side anastomosis of the inferior epigastric artery to the dorsal penile artery⁽²⁾. In 1984, Hauri⁽⁶⁾ modified the dorsal arterio-arterial anastomosis by including the deep dorsal vein. This consisted of a side-to-side anastomosis of the inferior epigastric artery to the arteriovenous fistula created by the previous anastomosis. The arteriovenous fistula is believed to reduce the chance of thrombotic occlusion by providing rapid blood flow through the anastomosis.

Arterialisation of the deep dorsal vein by anastomosis of the inferior epigastric artery to this vein was initially suggested by Virag^(2,3). This procedure has been applied to patients with arterial, venous and mixed impotence. Dorsal vein arterialisation is thought to produce retrograde arterial flow into the cavernous bodies through the collateral deep dorsal venous network or through a surgical fistula between the arterialised vein and the corpus cavernosum. The original technique was modified during the following years into 8 different versions⁽⁷⁾. The Virag 4-6 procedures involved the creation of a venocavernous window, whereas the other modifications(Virag 1-3, Furlow-Fisher, Lewis) were without this window^(1-4,7). The Virag-2 and Virag-5 are the most commonly performed of these procedures. Virag-2 consists of an end-to-side anastomosis between the inferior epigastric artery and the deep dorsal vein. The deep dorsal vein is ligated proximally and may be ligated distally depending on the pulsation in the glans following release of the clamps. The Virag-5 operation is identical to the Virag-2 but includes the creation of a venocavernous window. The Furlow-Fisher operation⁽⁴⁾ involves ligating the vein proximally and distally without creation of a venocavernous window.

Not all patients with vasculogenic impotence are candidates for penile revascularisation. The selection process involves a complete history, physical examination and psychological assessment. Hormone levels are determined. Those with a possible psychological cause are assessed by nocturnal penile tumescence studies and psychiatric consultation.

Stimulation of erection by intracavernous injection of vasoactive drugs (eg papaverine or prostaglandin

E1) is a useful diagnostic screening method for vasculogenic impotence, either arteriogenic or venogenic. An inadequate response to large doses of intracavernous vasoactive agents is generally thought to indicate that there is arterial or corporovenous insufficiency. If a patient consistently failed to respond adequately to intracavernous stimulation, there are additional studies to support the diagnosis of vasculogenic impotence. These include duplex sonography of the central arteries of the corpus cavernosum, dynamic infusion cavernosography and cavernosometry and selective pudendal arteriography. Dynamic cavernosography and cavernosometry are performed to exclude venous leakage. Selective pudendal arteriography is performed after the intracavernous injection of papaverine. Papaverine induced the vasodilatation necessary to opacify arteries of small calibre and stretch penile arteries that were tortuous in the flaccid state, thereby allowing a good morphological study to be performed.

Patients with diabetes mellitus, coronary artery disease, hypertension, marked peripheral vascular disease, who are older than 55 years and continue cigarette smoking are recognised to have more diffuse arterial disease and are therefore associated with a poorer post-operative outcome. The best candidates for arterioarterial revascularisation are patients with focal lesions of the internal pudendal or common penile artery and normal patency of the penile arterial tree distal to this. The most often are young men with a history of trauma and a documented isolated lesion on arteriography. Patients with diffuse arteriosclerotic occlusive disease and those with obstruction distal to the common penile artery on arteriography were not suitable candidates for the operation.

For patients with pathological cavernous or dorsal penile arteries, deep dorsal vein arterialisation is the preferred procedure. The six patients in our series underwent deep dorsal vein arterialisation. The advantages of this new technique are a simpler anastomosis and the absence of any degenerative atherosclerotic process in the receiving vessel. The anastomosis impedes venous flow. At the same time, additional arterial blood may be supplied to the corpus cavernosum by retrograde flow from the inferior epigastric artery to the dorsal vein and then through the emissary veins into the corpus cavernosum.

In our series, 4(66%) of our patients were considered to have either excellent or improved results with a mean follow-up period of 19.8 months. This was comparable to the results reported in several other series^(1,9-15). The success of penile revascularisation by all techniques reported in the literature ranges from 33% to 100% and the mean success rate tends to be about 70%⁽⁸⁾. Furlow and Fisher reported an overall success rate of 61% in 21 patients using the Furlow/Fisher modification of deep dorsal vein arterialisation⁽⁴⁾. Similar success rates were also reported in patients who underwent anastomosis of

the inferior epigastric artery to the dorsal penile artery. Michal et al reported successes with this operation in 60% (44 of 73) of cases⁽¹⁾. More recently, such investigators as Sarramon et al have reported similar success rates⁽¹⁰⁾. However, much of the literature is difficult to interpret or compare because of large differences in the mean age of patients, indication criteria, use of various operative techniques, subjective success criteria and length of follow-up.

Because of the flaws in diagnostic techniques and follow-up methods, the true incidence of long-term success of surgical outcomes in patients with vasculogenic impotence remains to be determined. With the evolution and refinement of new surgical techniques, there will undoubtedly be continuous improvement in success rates. There is a need for further prospective studies with longer follow-up as well as more objective post-operative tests of haemodynamic and erectile function. Only then will the true value of penile revascularisation for treatment of arteriogenic or mixed arteriogenic and venogenic impotence be known.

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