THE PREVENTION AND TREATMENT OF THE COMPLICATIONS OF TRANSURETHRAL PROSTATECTOMY

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Transurethral prostatectomy in selected cases of prostatic obstruction has only recently gained full acceptance as a satisfactory alternative to the open forms of prostatectomy. This operation has obvious advantages for both patient and urologist, but it is not a harmless urethral procedure devoid of complications. Misconception about the dangers of endoscopic surgery has resulted in a tendency in urological practice to carry out transurethral surgery to the exclusion of open prostatectomy. The axiom of fitting the operation to the patient, and not the patient to the operation, must be firmly adhered to, since the results will be most rewarding and the complications considerably lessened.

Transurethral prostatectomy may be carried out by either electroresection or the 'punch' method. The comments in this paper will be confined to transurethral prostatectomy by electroresection. However, many of the observations will be pertinent to prostatectomy by the 'cold punch' procedure, and also apply to the resection of bladder lesions by either technique.

It is beyond the scope of this paper to mention all the complications associated with transurethral prostatectomy. The general complications attendant on any major operation in a middle-aged or elderly patient will be discussed briefly. However, the main topic will be the complications peculiar to endoscopic surgery.

GENERAL COMPLICATIONS

1. Vascular

(a) Arterial. Thrombosis of the cerebral and/or coronary vessels is not uncommon. Hypotensive periods during and after operation must be guarded against and treated energetically.

(b) Venous. Thrombophlebitis and phlebothrombosis, with the ever-present danger of pulmonary embolism, are a constant hazard of prostatectomy. Breathing exercises, elastic stockings and early ambulation have decreased but not solved the problem of venous thrombosis. The dorsal lithotomy position favours venous stasis in the lower limbs. Care must be taken to avoid pressure on the calf muscles and popliteal spaces. Canvas boots attached to stirrups are useful in this respect. Holtgrewe and Valk[1] prohibit the use of the dorsal lithotomy position in patients with abdominal aortic aneurysms. They had two patients in whom the aneurysms started to dissect on the operating table.

(c) With the large number of patients with coronary artery

disease on long-term anticoagulant therapy, it is imperative, during history-taking, to ask specifically for this information. Failure to do so carries the grave risk of severe and sometimes fatal haemorrhage. It is advisable to wait at least 2 - 3 months after a recent coronary thrombosis before carrying out elective prostatectomy.

2. Neurological and Locomotor

Bed rest always has a deleterious effect in patients with neurological and locomotor disorders. Transurethral prostatectomy offers the best chance of early ambulation, since there is no pain or restriction of movement like that associated with abdominal wounds in the open forms of prostatectomy.

3. Skin

Diathermy burns must be guarded against.

4. Pulmonary and Cardiac

As in all operations on the elderly, a careful watch must be kept for the onset of early cardiac failure and the signs of pulmonary infection and/or atelectasis. Careful pre-operative assessment of the patient, and attention to postoperative breathing exercises, help play their part in keeping down the incidence of these complications. Stress should be laid on the choice of anaesthesia (spinal or general) and on its skilled administration.

5. Gastro-intestinal

Paralytic ileus is an uncommon complication of transurethral prostatectomy. When present it is usually the result of perforation of the prostatic capsule with extravasation.

6. Metabolic

Diabetes mellitus in varying severity is often present in patients requiring prostatectomy. Close liaison with a physician in controlling the disease is obviously important.

Drug allergies, and the ever-increasing number of patients who have received medication with tranquillizers or cortisone, make it mandatory to question them specifically about these. This may prevent a dangerous anaphylactic reaction which may be masked by anaesthesia, and which presents as unexplained sudden, and sometimes severe, postoperative collapse.

COMPLICATIONS PECULIAR TO TRANSURETHRAL PROSTATECTOMY

Weyrauch[2] described four factors which contribute to the high incidence of complications attributed to transurethral prostatectomy, namely:

1. No provision for drainage of peri-prostatic tissues.
2. Urethral trauma.
3. High-frequency electrical currents that devitalize a zone of surrounding tissue.
4. Absorption of fluids through the operative field.

These four factors are in turn responsible for the following complications:

1. Serious results of extravasation.
2. High incidence of urethral stricture.
3. Non-viable tissue left behind in the prostatic fossa with resultant persistent infection.
4. Circulatory disturbances resulting in the following conditions, either singly or in combination:
   (*a*) Hyponatraemic shock.
   (*b*) Acute renal failure.
   (*c*) Acute circulatory failure.

The prevention and treatment of these complications and other facets of transurethral prostatectomy will be best discussed in three phases: (1) pre-operative, (2) operative, and (3) postoperative — early and late.

1. Pre-operative Phase

Electrolyte imbalance. All patients who are to have a transurethral prostatectomy must be investigated fully as for any other form of prostatectomy, particular attention being paid to possible electrolyte imbalance. Uncorrected hyponatraemia in a patient subjected to transurethral prostatectomy may have very serious sequelae.

Renal function. Holtgrewe and Valk[1] emphasize the importance of waiting for a stable plateau of renal function to be established in patients with a raised blood urea. In these cases they limit their resection time to 60 minutes. Failure to do so contributes to an appreciably higher mortality and morbidity. They also comment on the unfavourable results in males operated on when they are over 70 years of age, and make a plea for early elective prostatectomy once the symptoms of prostatism are established.

Size and nature of gland. An accurate assessment of the nature and size of the gland is essential for successful surgery. Transurethral prostatectomy is best reserved for glands of 50 G. or less, but this is a rough approximation, since much depends on the operator's skill. Prostatic obstruction due to benign prostatic hypertrophy, vesical neck contracture, and carcinomatous glands with extension beyond the capsule, are well suited to endoscopic surgery. However, in some cases of carcinoma, landmarks may be obscured and the operation may be rendered hazardous.

Physical contraindications include hip disease, large irreducible scrotal hernias and urethral stricture. The judicious use of external meatotomy, perineal urethrotomy when indicated, pre-operative lubrication of the urethra, and irrigations with hexachlorophene, all minimize urethral trauma and subsequent stricture.

Mechanical factors. The success or failure of transurethral prostatectomy may hinge upon the mechanical side of the procedure. No effort should be spared to ensure that all resectoscopes and accessories are in perfect working order and that there is a complete range of spare parts. Surgeons using one-handed resectoscopes find a rectal sheath invaluable — it gives them a three-dimensional perspective of the operation. The diathermy machine should have foot control with both tube-cutting and spark-gap coagulation currents. There are few operations more time-consuming and frustrating than a transurethral prostatectomy carried out with a manually operated diathermy machine.

Anaesthesia. There is some controversy over the most suitable form of anaesthetic for transurethral prostatectomy. The American school favours spinal, and the British general anaesthesia, with notable exceptions on both sides of the Atlantic bridging the gap. The choice is usually left to the anaesthetist after prior consultation with both surgeon and patient.

Blood transfusion. Compatible blood should be readily available, as well as facilities for emergency blood-typing and cross-matching of large quantities, which are sometimes needed in unexpectedly severe haemorrhage.

Endoscopy. Immediately before resection a careful endoscopy must be made to identify landmarks and to detect any abnormalities which may be present. The knowledge of these may be invaluable when the operative field is partially obscured by bleeding. This refers particularly to previous undermining of the bladder neck, the presence

of a large intravesical middle lobe, asymmetrical lateral lobe enlargement and, not uncommonly, a much larger prostate than envisaged pre-operatively. If such a prostate is found, it might be much wiser to abandon the transurethral route and resort to open prostatectomy.

Irrigating medium. There must be provision for an adequate reservoir for the irrigating medium. An isotonic solution is preferable to plain water, which may lead to intravascular haemolysis.[3] As yet no ideal irrigant has been found. Pennisi *et al.*[4] summarized the properties which should be embodied in such a medium, viz: (*a*) isotonic; (*b*) easy to prepare, handle and store; (*c*) economical, with a refractory index similar to water; (*d*) non-toxic and non-haemolytic; (*e*) bactericidal; (*f*) easily diffusible in both intra- and extracellular compartments; (*g*) an osmotic diuretic; (*h*) of such a physico-chemical nature as to cause contraction of the venous sinuses; and (*i*) a solution which allows the return flow of sodium from the intra- to the extracellular compartment.

2. **Operative Phase**

The complications that occur during the actual operation may only present clinically during the postoperative phase. However, their early prevention, recognition and treatment will be discussed under four major headings as they occur during the operation:

A. Mechanical defects and deficiencies.
B. Excessive blood loss.
C. Errors in technique:
   (*a*) Bladder rupture
   (*b*) Damage to trigone
   (*c*) Loss of lobe in bladder
   (*d*) Damage to external sphincter
   (*e*) Perforation and extravasation.
D. Absorptive complications.

A. *Mechanical Defects and Deficiencies*

Inability to introduce the resectoscope may be caused by urethral stricture, false passages or a prominent middle lobe. Preliminary urethral dilatation and the passage of the instrument under direct vision usually overcomes these difficulties. Manual pressure on the perineum, or a finger in the rectum, are useful additional aids.

Deficient illumination arising during the operation must be pinpointed to either the resectoscope, light cord or battery.

If the loop fails to cut or coagulate properly, a careful inspection of the diathermy connections, the positioning of the indifferent electrode, the composition of the irrigating medium and the intact condition of the loop itself, usually helps to focus the trouble. Electrical shocks and sparking can occur and the wearing of glasses may prevent damage to the eye.

Muscle-twitching and movement of the legs may prove troublesome and occur even under deep general or spinal anaesthesia. This is due to heat stimulation of the sensory nerves in the vicinity of the operative site. Once this occurs the resectionist should strive to keep away from the area where stimulation takes place.

Priapism is usually controlled with muscle relaxants. However, perineal urethrotomy may be resorted to if resection becomes difficult.

B. *Excessive Blood Loss*

Estimation of blood loss during transurethral prostatectomy is much more difficult than in open prostatectomy. Spectroscopic estimation is most accurate, but not always available. A rough approximation is to allow for the weight of tissue resected. If under 50 G., estimate loss at 5 ml. per G., and over 50 G. at 10 ml. per G.

Expert haematological opinion and advice should always be sought when operating on patients with a blood dyscrasia. However, operation may be carried out without prior knowledge of a bleeding disorder on rare occasions, and the control of haemorrhage in these cases taxes the ingenuity of the urologist to the utmost. In a large percentage of these cases massive blood transfusion is required. Foote[5] drew attention to two main dangers of large transfusions:

(*a*) A haemorrhagic diathesis, which may have its basis in the reduction of coagulation factors in stored blood. It can to some extent be prevented by the use of a preparation of blood which is less than 72 hours old.

(*b*) Citrate and potassium excesses act to produce cardiac depression and arrhythmia. Calcium salts should be administered prophylactically where massive transfusion is given. Foote advocated larger doses than are commonly employed clinically at present.

C. *Errors in Technique*

(*a*) *Bladder rupture.* This usually results from overdistension, or the explosion of inflammable gases produced by high-frequency electrical currents. These hazards are greater at the end of the operation. Regular emptying of the bladder and the use of a low-level reservoir help to prevent this serious complication. If it does occur, immediate suprapubic cystostomy must be performed.

(*b*) *Damage to the trigone* and ureteric orifices may occur in the hands of the unskilled operator.

(*c*) *Loss of a lobe in the bladder* occurs with middle-lobe hypertrophy. One should not attempt to fragment it in the bladder, but should draw the tissue into the prostatic fossa and fragment it there, or wait until the end of the operation and extract it with a cystoscopic rongeur.

(*d*) *Damage to the external sphincter* may occur either on introducing the resectoscope or during resection. The instrument should always be introduced carefully and resection below the level of the verumontanum should be avoided. Landmarks may be obscured by carcinomatous involvement and it is safer to err on the side of caution in these cases.

(*e*) *Perforation of the prostatic capsule and extravasation.* This may have very serious sequelae. The thinnest fibres are at the bladder neck, and extra care must be observed when resecting in this region. Conger and Karafin[6] reported that small perforations and extravasation are more common than clinical signs indicate. These may be treated conservatively, but should be watched carefully since the clinical picture is sometimes obscured by the use of antibiotics. Large perforations are usually heralded by a bizarre irrigating pattern. The operation must be terminated immediately and suprapubic cystostomy carried

out. The peritoneal cavity should be examined if it is suspected that the perforation is opening into it. This is more likely with bladder perforations. If there is any doubt about the diagnosis, a cystogram should be done on the operating table, always taking a film after emptying to be sure the area of extravasation is not obscured by the cystoprostatogram. Holtgrewe and Valk[1] report that the mortality is high if large perforations are left untreated for more than two hours.

D. *Absorptive Complications*

These complications are limited to transurethral operations. Some fluid is absorbed through the prostatic venous sinuses with every transurethral prostatectomy, but the crucial factor is how much and what type of fluid.

The amount of fluid absorbed into the circulation is directly proportional to: (*a*) the amount of capsule exposed, (*b*) the number of venous sinuses opened, (*c*) the number of perforations and degree of extravasation, and (*d*) the pressure of the irrigating medium.

Prevention of excessive fluid absorption is determined by: (*a*) using an isotonic irrigating medium with low irrigant pressure, (*b*) avoiding complete exposure of the capsule, (*c*) keeping intravenous fluids to a minimum, (*d*) deferring resection of the deeper areas to the end of the operation, and (*e*) terminating the operation when there is either a large capsular perforation, excessive venous bleeding or the onset of hypertension.

These measures will minimize the inherent dangers of abnormal fluid absorption, viz: (*a*) circulatory overloading with cardiorespiratory difficulties, (*b*) fluid and electrolyte imbalance and hyponatraemic shock, (*c*) intravascular haemolysis and possible acute renal failure, and (*d*) bacteraemia and/or septicaemia.

However, even in the best hands the 'transurethral reaction' continues to occur. This is a syndrome arising from fluid and electrolyte imbalance (predominantly hyponatraemia) which may result, in untreated cases, in irreversible shock. The urologist must recognize it and treat it early.

Clinically, the first signs are bradycardia and hypertension. However, the patient may be normotensive or even hypotensive. Under spinal anaesthesia restlessness is a useful diagnostic sign.

The operation should be terminated and the following regime adopted, as recommended by Ceccarelli and Smith[7] and by Berg, Fedor and Fisher:[8]

(*a*) If there is associated extravasation, suprapubic cystostomy should be carried out combined with the administration of 200 - 300 ml. of 5% hypertonic saline given over the course of 2 - 4 hours. This allows more rapid absorption of the extravasated fluid and helps correct the electrolyte imbalance. The patient must be observed carefully for the onset of pulmonary oedema, and treated vigorously if it arises.

(*b*) If there is no extravasation, Pierce[9] states that hypertonic saline may cause acute expansion of the extracellular fluid volume and may be dangerous and potentially lethal. He advocates 200 - 300 ml. of a 30% solution of hypertonic urea, which promotes an osmotic diuresis and causes a more transient rise in the extracellular fluid volume, and is therefore less likely to produce pulmonary oedema. In addition, urea has possible anticonvulsant properties.

3. **Postoperative Phase**

Complications during this period may present themselves immediately or not become apparent until weeks or months later.

Fluid balance and catheter drainage. During the first 48 hours or early postoperative period, attention is focussed on the maintenance of a satisfactory fluid balance and a careful watch is kept on catheter drainage. The catheter should be connected to a sterile, closed, underwater drainage system. Routine irrigations may do more harm than good and are a potent source of introducing sepsis; they should be carried out only if drainage is faulty.

Antibiotics. The routine administration of antibiotics is a contentious subject. Sulphonamides may be preferable, with antibiotics reserved for infectious complications should they arise.

Reactionary haemorrhage is usually due to arterial bleeding. If this is excessive, the patient should be returned to the operating theatre and re-anaesthetized, and haemostasis secured with the resectoscope.

Secondary haemorrhage occurs usually around the 10th day. However, bleeding may occur as late as 4 weeks after operation. The vast majority of cases with clot retention require no more active treatment than emptying the bladder of clot and the introduction of continuous catheter drainage for a few days.

Evidence of *infection of the seminal tract* usually occurs in the late postoperative period. Prophylactic vasectomy has done much to minimize and prevent this complication.

Urinary incontinence is usually due to damage in the region of the external sphincter. It may be partial or complete, temporary or permanent. The presence of incontinence 6 - 8 weeks after operation demands a thorough urological investigation. No effort should be spared to uncover a remedial cause, since mechanical devices and operations to cure incontinence are generally unsatisfactory.

Postoperative urinary obstruction and stasis arise either from bladder atony, bladder neck contracture, residual prostatic tissue, or urethral stricture. These may occur singly or in combination. Urethral stricture, as previously outlined, is usually preventable. Residual prostatic tissue denotes an inadequate resection, and the incidence of bladder neck contracture may be considerably lessened by the avoidance of excessive coagulation and the use of the finest cutting loops. Bladder atony is often helped by prolonging catheter drainage. In severe cases partial cystectomy may be required.

SUMMARY

Transurethral prostatectomy is today a firmly established operation for the relief of obstructive prostatism. It offers the patient a relatively pain-free postoperative convalescence, the advantages of early ambulation, and none of the dangers of abdominal wound healing. The latter alone is of immense psychological benefit. However, the urologist must have a sound training in endoscopic surgery, and pay careful attention to basic fundamentals and details, before, during and after operation, if transurethral prostatectomy is to fulfil its expectations and he is to safeguard the patient from its hazards.

The prevention and treatment of the complications of transurethral prostatectomy by electroresection during the pre-operative, operative and postoperative periods are discussed.

The future of transurethral prostatectomy lies in the hands of skilled urologists, with the benefit of modern technical refinements in their instruments, and the active

research directed towards finding a more ideal irrigating medium.

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