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European Association of Urology

Editorial – 50th Anniversary

Celebrating the 50th Volume of European Urology, "Your" Platinum Journal

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Having the opportunity to celebrate with you, our readers, the 50th volume of European Urology, "your" Platinum Journal is a major honour and pleasure for us. The Journal has been continuously evolving over the last 30 years, being the witness of the most significant discoveries in the field of urology. All our readers have been the only protagonists of this exciting story which has been recently described in detail [1].

As you all know, with the change of the Editorial Board which occurred in January 2006, the Journal has completely renovated its layout and a number of new sections have been launched. The new definition of "Platinum" is aimed at describing the objective that we want to pursue in the near and more distant future: publishing your best research in the most timely fashion and making it accessible to the largest possible number of readers worldwide [2,3].

While heading towards the future, European Urology does not want to forget its roots. As we all recognize the importance of learning from past experiences, we have carefully scrutinized the first 49 volumes of the Journal to identify a number of landmark articles which we believe are worthy to be remembered and have published them once again in their original layout. We then asked recognized authorities in our field to write a short commentary on each one of these European Urology "greatest hits."

In this issue of the Journal the authors of this Editorial have selected two articles that were published in the very first volume of European Urology, back in 1975. We think they are paradigmatic for the classic evolution of medicine and science in general which implies that some discoveries will resist the test of time while other techniques or general concepts will be abandoned.

Is there a practising urologist who does not use the Iglesias resectoscope in his daily practice? The authors of the present editorial are different witnesses of the evolution of endoscopic treatment of benign prostatic enlargement and bladder tumors. At the beginning of his career, the senior author experienced the need to periodically interrupt the resection of either prostatic or bladder tissue in order to evacuate the accumulation of bloody fluid from the bladder and maintain the intravesical pressure constantly below 10 mmHg. The first author was fortunate enough to practice his first endoscopic resections already with the Iglesias instrument, thus having the opportunity to learn the technique in a safer environment. The article titled "*Iglesias resectoscope with simultaneous irrigation, suction and low intravesical pressure*" was authored by Jose J. Iglesias, originally from Cuba, and Giuseppe Fiore, from the Division of Urology at the College of Medicine and Dentistry of New Jersey, USA. In this article the authors describe in detail the design of this revolutionary instrument. The outer and inner

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sheaths had a 28 F and 25 F size, respectively and the volumetric capacity of the outflow conduit was smaller than the inflow conduit to avoid the accumulation of irrigating sterile water inside the bladder. The authors recommend that intravesical pressure did not exceed 10 mmHg to prevent the absorption of the electrolyte-free irrigant. The authors also suggest to maintain the irrigant fluid bag at 70 cm of height above the operating table demonstrating that this pressure is able to push the resected pieces of tissue to the bottom of the water while reducing bleeding, keeping the visual field clear and avoiding air bubbles. The authors advocate the use of a camera connected to the resectoscope to improve visibility for the surgeon and to facilitate teaching. Clearly the continuous flow instrument opened the door to learning about performing transurethral resections more easily!

This discovery was not immediately perceived as being so important. A few months prior to the publication of this article Dr. Iglesias visited the Department of Urology in Brussels chaired by Prof. Willy Gregoir in order to demonstrate the new principle supporting his technique of transurethral resection. The immediate reaction by Prof. Gregoir was skeptical as he considered the new resectoscope to be a new toy possibly useful only for young residents still in the learning phase for transurethral resection of the prostate and bladder! This was probably the initial reaction from the vast majority of urology department chairmen throughout Europe.

We are convinced that many residents in training will be interested in reading this classic article where they will find the original source of many fundamental principles of transurethral surgery learned by their Mentors.

Is there a practising urologist who is still using the technique of open surgery and hypothermia to treat kidney stone disease? The second article that we selected from the first issue of European Urology is titled *''100 cases of nephrolithotomy under hypothermia''* and is authored by the group of one of the best known pioneers of modern urology, Mr. John Wickam, having N. Coe and J.P. Ward as co-authors. In this article the authors describe in detail an innovative technique which is based on the use of two new concepts: 1. the use of a specially contoured ring retractor to provide good operative exposure and leave the assistant hands completely free during the procedure; 2. the use of heat exchange coils and an external cooling unit. Extraction of multiple stones from the kidney is obtained by performing a posterior pyelotomy and multiple direct nephrotomies and the advantage highlighted by the authors is the dry operative field without any significant deterioration of kidney function. The concepts expressed by these authors were certainly innovative in 1975 and many senior practising urologists have probably done many of these procedures. At the same time, the advent of ESWL and percutaneous techniques have clearly outdated this technique.

Should we then forget this article? We are convinced this is not the case because the eyes of the clever reader would never underestimate the lesson which should be learned by all of us: the advance of medicine and science in general is based on innovations and innovations derive from human thoughts coming from brilliant minds. In other words progress dies due to further progress.

All of us have the potential opportunity to mark a significant step forward in our specialty by pursuing our ideas using a correct methodology aimed at verifying whether they can or cannot be really innovative!

We are sure that you will enjoy reading the classic European Urology articles and commentaries that we have selected for you to be published in all issues of the 50th volume of ''your'' Platinum Journal.

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Iglesias Resectoscope with Simultaneous Irrigation, Suction and Low Intravesical Pressure

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Key Words. Controlled intravesical hydrostatic pressure during TUR · Iglesias resectoscope with continuous irrigation · Transurethral resection of bladder tumors (TUR-BT) · Transurethral resection of prostate (TUR-P) · TUR syndromes

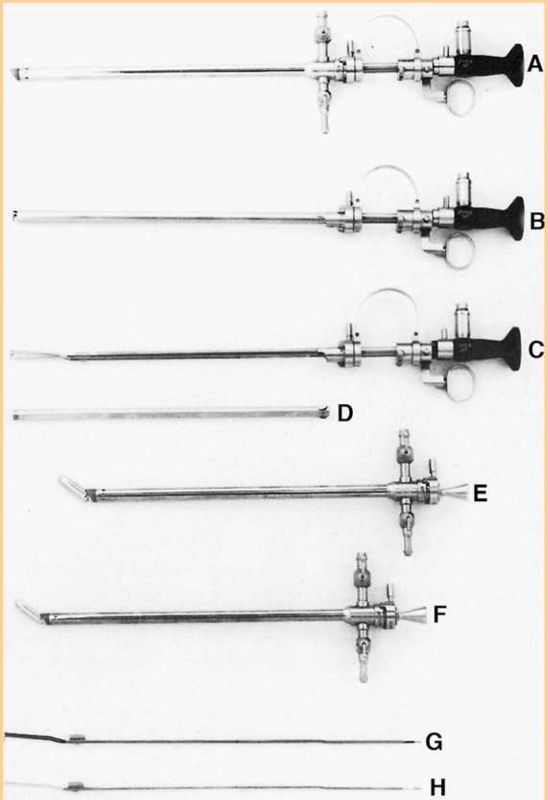
Abstract. A resectoscope with continuous irrigation, suction and low intravesical pressure has been described. Advantages of this instrument include: no interruption, better endoscopic vision by a continuous clear inflow of more than 500 ml/min at 70 cm pressure, less bleeding, no air bubbles, constant intravesical pressure less than 10 mm Hg during TUR, permitting the absorption of the irrigant, shorter operating time, easier teaching and no more wet floor and wet surgeon. Since the entire amount of irrigating fluid is collected, blood loss can be calculated and the amount of absorption determined.

This resectoscope has been designed to avoid the present inconvenience of periodically interrupting the resection in order to evacuate the accumulation of bloody fluid from the bladder and maintain the intravesical pressure constantly below 10 mm Hg. Using isotopes, *Madsen and Nebes* (1973) established 30 mm Hg as the initial intravesical pressure for irrigant absorption during transurethral resection of the prostate (TUR-P).

The new resectoscope has two conduits, one for the inflow of clear fluid, and the other for the outflow of bloody fluid from the bladder. Both are completely separated and have their distal opening located at different sides in the beak of the resectoscope sheath. The resectoscope has two sheaths: the 25-Fr. accommodating the yellow 26-loop, and the 28-Fr. sheath accommodating the black 28-loop (larger than the blue). The 25-Fr. sheath can be used for most of the cases. The parts of this instrument may be seen in figures 1–3.

The volumetric capacity of the outflow conduit is smaller than the inflow conduit. In order to maintain the bladder at a low intravesical pressure, suction is applied to the outflow to establish an equal rate of flow in both conduits. Clear fluid is constantly flowing in front of the lens. The inflowing fluid irrigates the operative field before being evacuated via the outflow conduit. The bladder and the prostatic urethra must be moderately distended to allow exact visualization of the pathological changes at the prostatic urethra. The intravesical hydrostatic pressure should be under 10 mm Hg to prevent the absorption of the electrolyte-free irrigant. To maintain the bladder and the prostatic cavity adequately distended at all times with an inflow of over 500 cm^3 of fluids/min, with the irrigant at 70 cm height, it is necessary to regulate the suction pump. We have learned in our research, while measuring the intravesical pressure, that the bladder can adequately be distended at pressures less than 10 mm Hg or 13.6 cm of water. At those levels of pressure, the resectionist is able to see the posterior wall of the bladder, while the resectoscope is in the prostatic fossa.

The two conduits are established by a fine metallic inner tube, which encompasses the entire length of the telescope together with the stem and arms of the cutting loop (fig. 3). This tube is smaller than the sheath in cross section. Its distal end closes the space between the inner tube and sheath. The proximal end is attached either to the working element or to the sheath. The space between the sheath and the inner tube is the outflow conduit. The inflow conduit is within the inner metallic tube as is the free space surrounding the telescope, loop, stem and arms. The inflow conduit discharges in front and below the distal end of the telescope. At the beak, the 70 cm H_2O pressure of the inflowing irrigant pushes the resected pieces of tissue to the bottom of the bladder and reduces the bleeding. Bloody irrigant from the bladder enters the outflow conduit by way of multiple events around the distal part of the sheath preventing resected pieces from blocking the outflow entrance. At the upper proximal end of the sheath socket, the inflow conduit communicates with an external tube connection through which clear irrigating fluid flows to the operative field. The outflow conduit communicates at the lower part of the socket with an external tube to which suction of 15 inches of Hg is applied. The tube for the suction should be transparent having a fusiform dilatation at its connection with the resectoscope to avoid turbulence and collapsing of the plastic tube.



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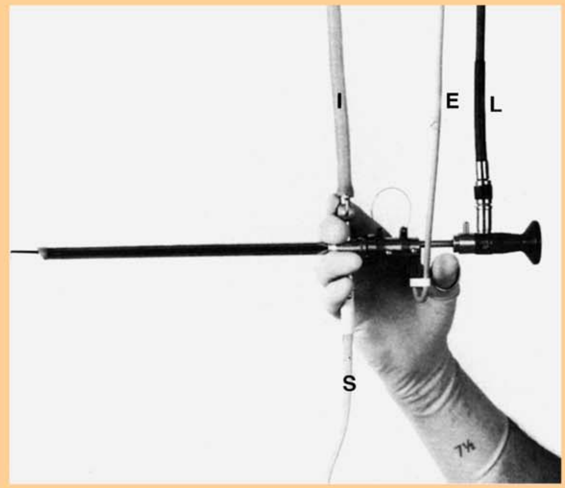

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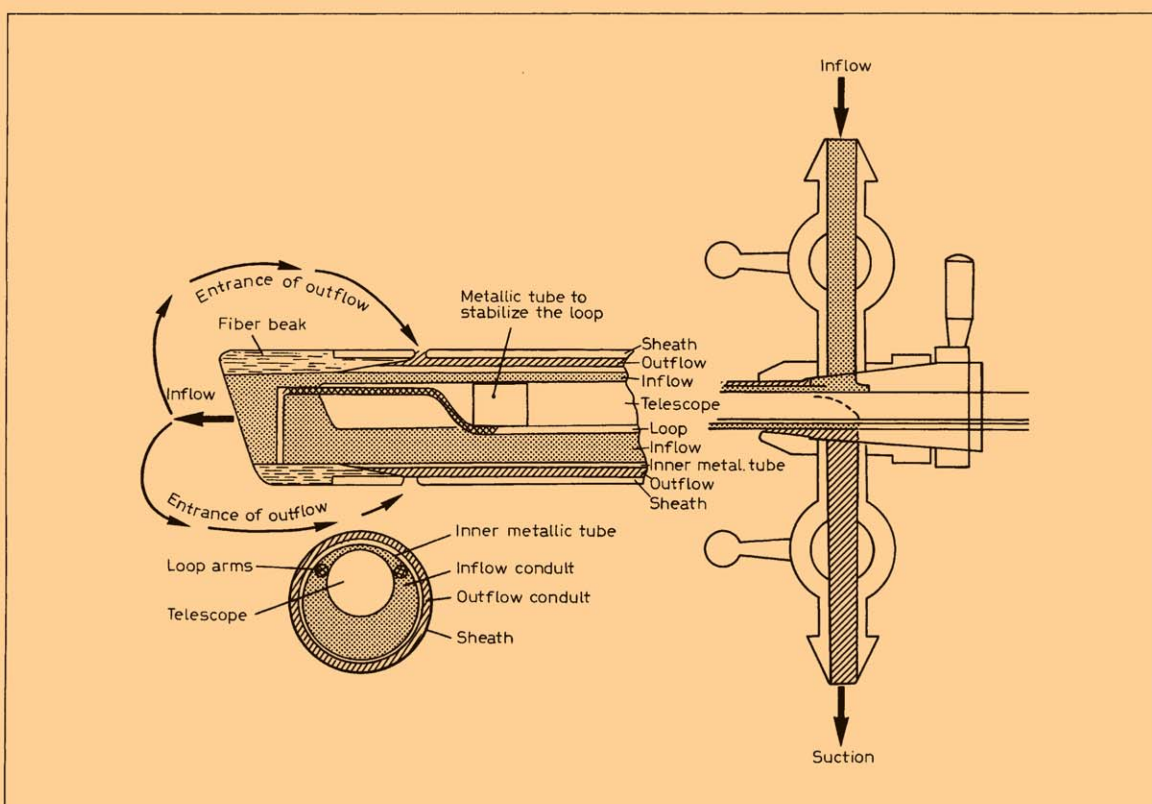
Fig. 1. *A* Resectoscope No. 28 sheath. *B* Resectoscope No. 28 with sheath removed. *C* Resectoscope No. 25 after removal of inner metallic tube. *D* Inner metallic tube of No. 25 Fr. *E* No. 28 Fr. sheath with obturator. *F* Sheath No. 25 with obturator. *G* Loop for the No. 28, black. *H* Loop for the No. 25, yellow.

Fig. 2. Irrigation tube (I); high frequency electrical current (E); light bundle cord (L); and suction tube (S).

Fig. 3. Gross section of Iglesias resectoscope with continuous irrigation, suction and low intravesical pressure.



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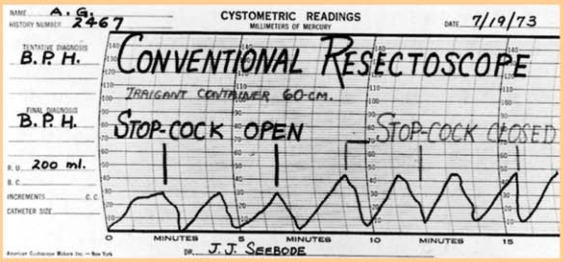

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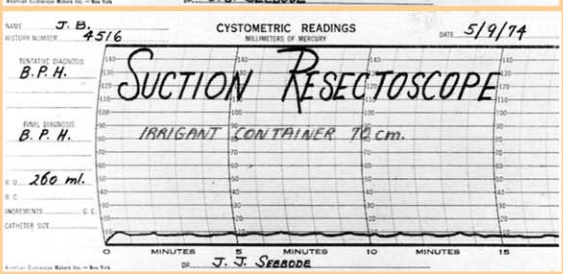

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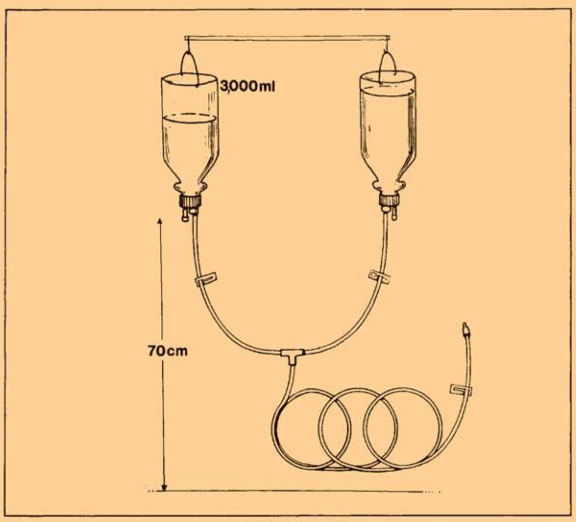

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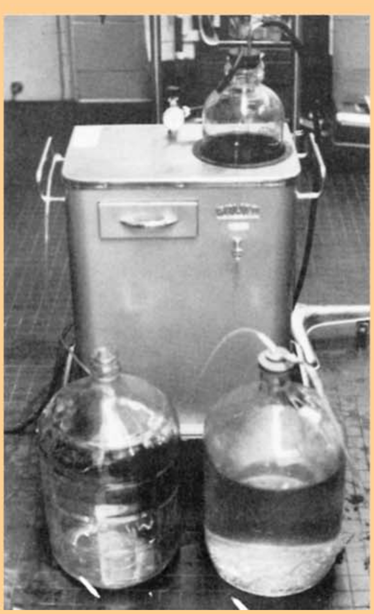

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Table I. Typical protocol form demonstrating preoperative and postoperative findings while using the Iglesias resectoscope with continuous irrigation suction and low intravesical pressure

Name:	A.G.	Operative time:	35 min
Age:	64 years	Adenoma weight:	45 g
Diagnosis:	BHP	Irrigant used:	24 l H_2O
		Bloody fluid sucked:	23.5 l

	Preoperative	Postoperative
Blood pressure	149/90	135/90
Serum osmolality, mosm	289	287
Weight, lb.	145	145
Serum-free hemoglobin, mg%	2.4	2.3
Serum sodium, mEq%	138	142
Serum chloride, mEq%	104	102
Serum potassium, Eq%	3.2	3.2
Hematocrit, %	39	40

Both external tubes are supplied with stop-cocks. Just proximal to the outflow stop-cock there is a filter device which prevents the suction tube from becoming plugged by the tissue chips. By operative monitoring of intravesical hydrostatic pressure and observation of serum chemistries, pre- and postoperative weights, and volume of irrigants used, we have found that there is a minimal absorption of irrigant at an intravesical pressure under 10 mm Hg. A typical patient record is seen in table I. Above this critical pressure, absorption of irrigant rapidly increases. During our research with the new resectoscope, a fine suprapubic catheter connected to a Lewis cystometer or to a water manometer allowed continuous monitoring of the intravesical pressure which was maintained below the critical 10 mm Hg. A typical tracing is seen using the conventional resectoscope and the new suction resectoscope in figure 4.

The handling of this resectoscope is very simple. The air entrance at the 3-liter irrigating flasks should be at 70 cm above the level of the operating table. The system of irrigation should have a Y connection using only one flask at a time to be able to have a continuous constant pressure of 70 cm of water at the inflow (fig. 5).

Small connections or tubes must be avoided to have the maximum of inflow volume at 70 cm water pressure. The inflow pressure has to be constant and never below 70 cm H_2O, during the whole procedure, to push the resected pieces to the bladder, to reduce the bleeding without increasing the hydrostatic intravesical pressure, and to keep the visual field clear of air bubbles. Decrease in the inflow increases the bleeding and air bubbles. *A suction of 15 inches Hg (38 cm Hg) is applied to the ouflow conduit only after the posterior wall of the bladder is completely separated from the bladder neck while the bladder is filling. Suc-*

Fig. 4. Continuous intravesical pressure recording by Lewis cystometer via suprapubic cystocath during TURs using the conventional resectoscope and the suction resectoscope.

Fig. 5. System of irrigation.

Fig. 6. System of suction at 15 inch Hg (40 cm) to a 20-liter flask.

tion is regulated by the pump to maintain the posterior bladder wall away from the bladder neck, at any intravesical pressure below 10 mm Hg. During the whole operation the bladder is never distended. The suction pump is connected to one container of 20 liters to collect the bloody fluid from the bladder (fig. 6). Maximum visibility and minimal bleeding are realized with undisturbed hemodynamics and undetectable irrigant absorption if the periprostatic sinuses are not opened. The performance, teaching, still photo, endoscopy movie and TV, during transurethral surgery is made easier. The attending surgeon is allowed to appreciate the amount of bleeding through the transparent tube of the suction.

Most of the explosive gases produced during resection could be removed from the bladder with the use of suprapubic trocar suction, thus avoiding possible explosion, which has been reported. The vacuum pump must be adjustable between 38 and 50 cm of Hg vacuum. The loop must be in the correct position prior to beginning surgery. *This is achieved when the loop is situated inside of the sheath while viewing through the telescope at rest position. When it is necessary to replace the loop during the procedure the lower arc of the cutting loop should be at the same level of the inner metallic tube. In this way the loop always enters into the sheath at the rest position. When evacuating pieces of tissue from the bladder, the outflow stop-cock should be closed to ensure it will not become blocked.*

Advantages

(1) Periodic interruptions in the resection in order to evacuate the bladder are eliminated. This allows the resectionist uninterrupted resection and concentration on the field of resection without the previous frequent reorientation. This shortens operative time.

(2) The ability to control the amount of distension of the bladder and prostatic fossa at a constant pressure below 10 mm Hg decreases the likelihood of extravasation and/or absorption of the irrigant.

(3) A superior endoscopic vision is maintained at all times by the continuous flow of more than 500 ml/min of clear fluid at a constant pressure of 70 cm of water, decreasing the bleeding and avoiding the air bubbles. The irrigant must be at 70 cm height and the hydrostatic intravesical pressure below 10 mm Hg (13.6 cm H_2O). It is easier to visualize the exact amount of obstructing tissue to be resected, thus avoiding injury to the muscular fibers of the true prostatic capsule, of the internal and external sphincters and the opening of the periprostatic venous sinuses. It makes easier teaching, still photo and movie in TUR surgery. We are using the new rigid optical unit for these purposes and color TV and tape.

(4) Less bleeding and less operative time is required for hemostasis with most of the time being employed for resection. Blood and blood clots do not accumulate in the bladder. Less irrigating fluid is used.

(5) The possibility of explosion of accumulated gases in the bladder is avoided.

(6) During resection of bladder tumors, the bladder is maintained at the same distension, thus allowing easy resection, good vision and excellent hemostasis.

(7) The 'TUR syndromes' are eliminated because the hydrostatic intravesical pressure is maintained below 10 mm Hg, the critical pressure for irrigant absorption.

(8) Operative time is reduced by an average of 50 %.

(9) It permits transurethral resection of larger glands. It allows removal of resected chips from the bladder when they are too large to be evacuated by suction, by means of grasping the tissue between the loop and the inner tube.

(10) The simple measurement of irrigant inflow and outflow allows calculation of irrigant absorption. The level of hemoglobin in the irrigating fluid can be converted to blood loss.

(11) No more wet floor and wet surgeon.

(12) Plain sterile water, the best irrigant, can be used safely.

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Eur. Urol. *1:* 71–74 (1975)

100 Cases of Nephrolithotomy under Hypothermia

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Key Words. Renal hypothermia · Staghorn calculus · Nephrolithotomy

Abstract. Regional renal hypothermia has been used as an aid to nephrolithotomy in over 100 cases of nephrolithiasis. The long-term follow-up and the effects of the procedure on renal function are reported.

The technique of regional renal hypothermia for complicated nephrolithiasis has previously been described (*Wickham et al.,* 1967, 1971).

From 1968 to 1974 more than 160 kidneys have been operated upon under regional cooling and the results of the first 100 kidneys with calculous disease consecutively treated are reported. The 'dry field' technique provided by renal artery occlusion coupled with local cooling provides the operator with a clear and detailed view of the intrarenal anatomy, minimises the risk of damage to the finer vasculature and avoids subsequent loss of renal function. Secondly it allows more than ample time to perform a planned and detailed operation without anxiety over deteriorating renal function in an ischaemic situation.

Operative Technique

Incision is through a standard loin incision excising the anterior end of the twelfth rib.

Retractor. A specially contoured ring retractor is then inserted (fig. 1). This instrument has been developed to provide good operative exposure and leave the assistants hands completely free.

Netelast gauze. When the kidney has been fully mobilised 'Netelast' gauze elastic bandage size B (Roussel) is stretched over the kidney (fig. 2) to provide an atraumatic sling for the organ and prevent bruising from handling during the operation.

The renal artery is next exposed and isolated with a nylon tape. A small bull-dog clamp is placed on the artery to arrest the circulation. Whole pedicle clamping is not necessary and produces intrarenal congestion.

The heat exchanger coils (fig. 3) are then placed on either side of the mobilised kidney and cooled water is circulated from an external cooling unit.

The cooling unit (fig. 4) which is basically a refrigerated reservoir of water at 1 °C. From this large volume reservoir of 16 litres capacity, water is conveyed to the coils at a rate of about 1.5 litres/min by a high speed pump which maintains a coil surface temperature of 1–2 °C. The apparatus is now made commercially by Pye Dynamics Ltd., Cambridge, England. A telethermometer unit is built into the unit and is supplied complete with a needle probe to monitor intrarenal temperature during cooling.

Cooling is continued until the deep core renal temperature has been lowered to between 15 and 20 °C. Cooling takes about 8 min for the average sized kidney. The coils are then removed and the operation can proceed in a clear dry field without the encumberance of crushed ice, saline slush or plastic ice water bags which have been used in the past. During the procedure, rewarming to 30 °C occurs over 35–40 min and if a further extension of ischaemic time is required, a simple reapplication of the coils will again take the temperature to 15 °C; a difficult task with the crushed ice method.

Extraction of calculi. With complete staghorn calculus the pelvic portion of the stone is removed through a posterior pyelotomy incision. Calyceal calculi are then removed through multiple small radially disposed nephrotomies in the renal parenchyma. Because of the dryness of the field, it is possible to visualise the major intralobar vessels and displace them to one side with a blunt dissector. A small fibrelight calyceal speculum is then inserted into the calyx and a thorough search for all stone fragments is made under direct vision.

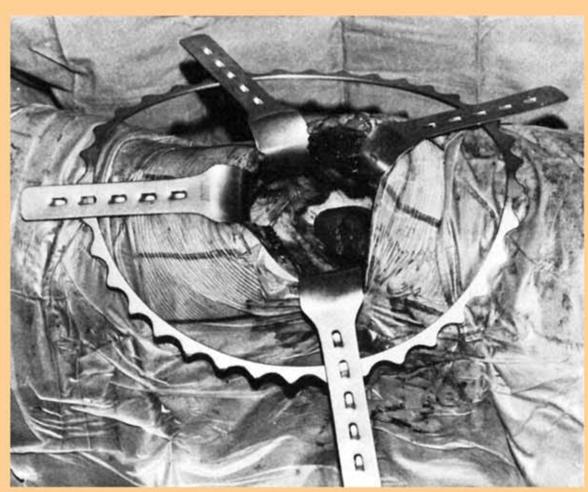
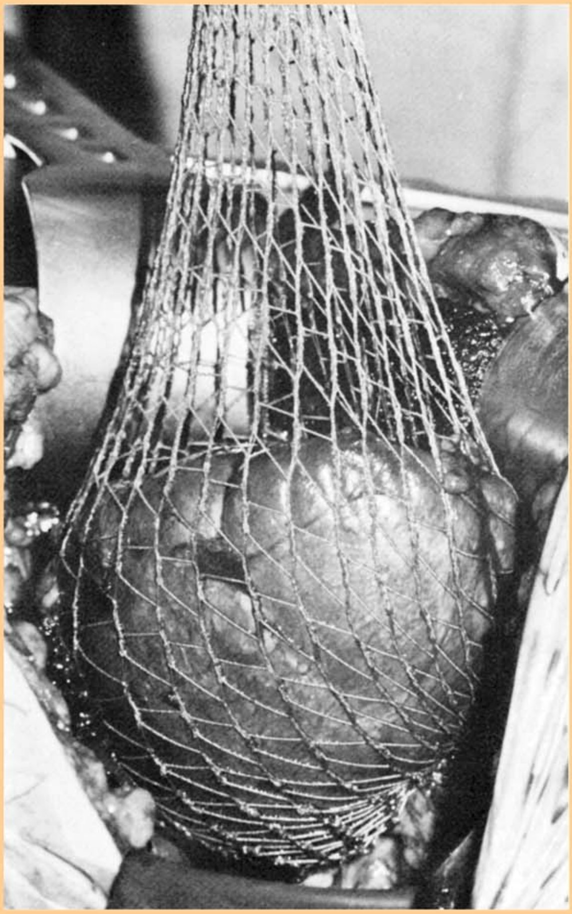


Fig. 1. Specially contoured ring retractor.



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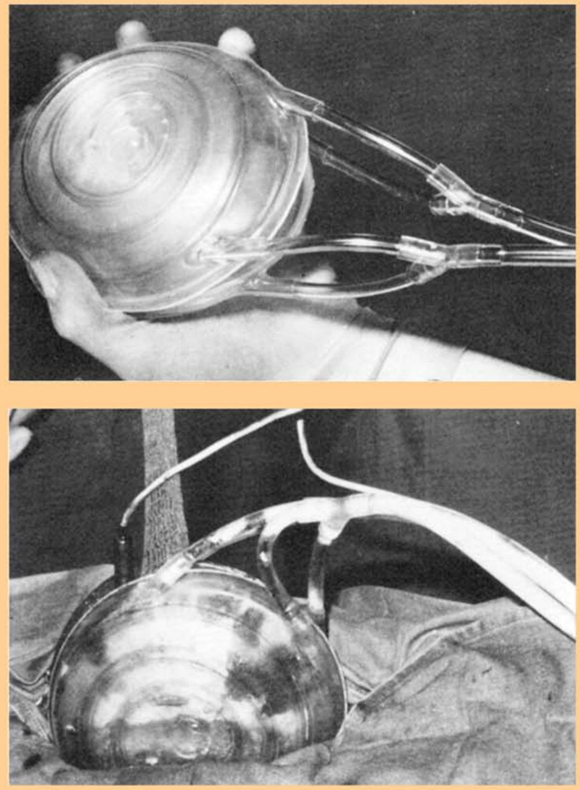

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Fig. 2. 'Netelast' sling around the kidney.
Fig. 3. *a* Heat exchanger coils. *b* Coils in use.

High pressure flush. 1.0-litre bags of sterile normal saline are pre-cooled in a domestic refrigerator and when required are placed in a Fenwall bag compressor and connected to a malleable antrum cannula by a sterile drip extension tube. The bag is then compressed to give a high pressure irrigating jet by means of which small crumbs of calculus may be flushed from the calyces onto swabs packed in the base of the wound.

Contact radiography. When all macroscopic calculi have been removed, Cushing silver clips are attached to the 'Netelast' gauze as localising markers and close contact X-rays are taken to exclude the presence of residual stone fragments which if discovered are removed via further nephrotomy.

Closure. When all stones have been removed, the nephrotomies are closed by simple suture of the renal capsule with 4 (O) chromic catgut stitches. Due to the avoidance of the major intralobar vessels during incision, deep and damaging haemostatic suturing is not required. Finally, a 12F nephrostomy tube is placed in a lower calyx, the pyelotomy is closed and the wound closed with drainage.

Patients

These were a consecutive and random group of 85 patients with 100 kidneys involved with nephrolithiasis such that complete removal of their calculi could not be achieved except by incision of the renal paranchyma (fig. 5). Many of the cases had staghorn calculi knowingly present for long periods, in one case for at least 30 years. The majority of these patients had been troubled with recurrent urinary tract infections and symptoms of fever, loin pain – often severe, frequency, haematuria and recurrent dysuria.

In a number of cases the collecting system of the kidney was completely, or almost completely, obstructed by the position of the stone at the pelviureteric junction, and in two patients the kidney was pyonephrotic.

Age ranged from 16 to 67 years (mean 40.5 years). 34 patients were male and 66 were female. 70 patients had unilateral stones and 15 had bilateral stones and needed bilateral operations. The period of follow-up ranged from 14 months to 5 years and 1 month (mean follow-up: 2 years 4 months).

Metabolic abnormality. All patients were screened for metabolic abnormalities known to contribute to calculous formation. Duplicate estimations of serum calcium, phosphorus and of 24-hour urinary calcium and phosphorus excretion, plasma uric acid, and urinary screening for cystine were made.

Estimation of renal function. 2 × 24-Hour endogenous creatinine clearance tests were performed wherever possible before and after operation and at 3-month follow-up. Serum creatinine was estimated at similar times and at 1-month follow-up.

Radiological evaluation. All patients had an IVU pre-operatively and 3 months post-operatively. Contact films were taken at the time of operation and a nephrostogram and plain renal X-ray were taken about 8 days after the operation to exclude residual calculi in ureter or kidney.

Results

Mortality: none. Secondary nephrectomy: one for persistent bleeding from a kidney subsequently found to con-

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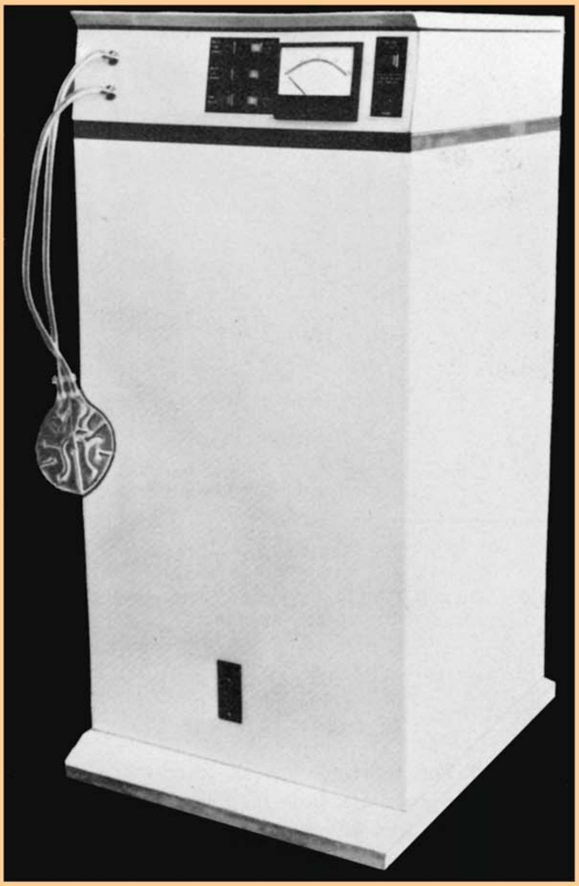


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Fig. 4. Renal hypothermia cooling unit.
Fig. 5. Plain radiograph of bilateral staghorn calculi.

tain multiple staphylococcal abscesses. Urinary fistula: none. Blood loss: 76 % of patients lost less than 500 ml of blood; 20 % of patients lost between 500 and 1,000 ml of blood, and 4 % of patients lost more than 1,000 ml of blood. The average ischaemia time for the group was 53 min with a range of 9–118 min.

Metabolic abnormality: 66 % of all patients showed no detectable abnormality on metabolic screening, and 34 % of patients had some detectable metabolic abnormality. Chemical analysis of the calculi removed: the principle stone types analysed are shown in table I.

Table I

Stone type	Age, %
Triple and mixed phosphatic	74
Calcium oxalate	13
Cystine	9
Uric acid	2
Lost	1

Effect of Operation on Urinary Tract Infection

The effect of the operation coupled with appropriate antibiotic treatment is shown in table II. Patients with sterile urines at the limit of their follow-up were not on antibiotic therapy. All calculi removed were cultured bacteriologically. Where the pre-operative MSU was infected, in all but two cases the organism grown from the stone matched exactly the organism grown from the urine. In ten cases where the pre-operative MSU was sterile, organisms were grown from the excised calculus.

Table II

Organism	Pre-op.	Post-op.		Stone
	1 month	limit of FU		
Sterile	51	72	91	38
Proteus	24	14	0	31
Coliform	21	8	6	27
Pseudomonas	4	6	3	4

Success of Clearance of Calculi at Operation

9 % of kidneys had residual fragments of calculi which were considered capable of surgical removal; 15 % of kidneys had minute particles of calcification which were considered to be within the parenchyma and were not amenable to surgical removal, and 76 % of kidneys were completely cleared of all radiologically visible calculi.

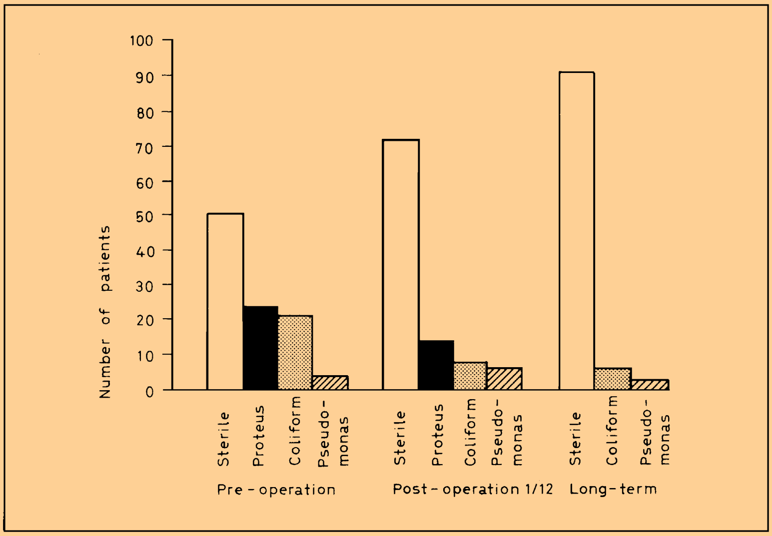

Fig. 6. Effect of treatment on urinary tract infection.

Recurrence of Calculi at Duration of Follow-up

Eight patients in the whole series had developed recurrent calculi at the limit of their follow-up and all but one exhibited metabolic abnormality; four had cystinuria, and three had hypercalciuria. One patient with urinary infection, but no metabolic abnormality, developed calculous recurrence at 3 years, but the infection had never been well controlled after operation.

Effect of the Operation on Renal Function

Creatinine Clearances

68 % of patients had duplicate creatinine clearances performed pre- and 2 weeks post-operatively. A paired T test between the values pre- and 2 weeks post-operatively revealed a mean reduction of clearance of 3.78 ml/min with a standard deviation of 24.5 ml/min. $T = 1.272$ with $p = 0.208$ – a *non-significant reduction* in renal function.

56 % of patients had duplicate creatinine clearances performed at their long-term follow-up appointments. A paired T test between the pre-operative and long-term follow-up values showed a mean improvement in clearance of 9.38 ml/min with a standard deviation of 24.5 ml/min. $T = 2.184$ and $p = 0.0332$ – a *significant increase* over pre-operative function.

Serum Creatinine Levels

85 % of patients had duplicate serum creatinine estimations pre- and 2 weeks post-operatively. A paired T test between the pre- and 2 week post-operative values showed a mean increase of 0.2 mg% with a standard deviation of 2.3 mg%. $T = 0.844$ with $p = 0.4011$ – a *non-significant decrease* in renal function.

63 % of patients had duplicate serum creatinine estimations performed pre-operatively and then at their long-term follow-up appointments. A paired T test between pre-operative and long-term values showed a mean decrease of 0.18 mg% with a standard deviation of 0.66 mg%. $T = 2.209$ and $p = 0.0309$ – a *significant improvement* in function.

Conclusions

General. This technique appears to be a surgically safe and accurate procedure, both for the patients and for the kidney. Blood loss is usually slight and post-operative wound infection and fistulation is not a problem.

Renal function. In some cases may be slightly depressed after operation but has recovered to its initial value in all except three cases. There has been significant improvement in creatinine clearance and serum creatinine levels in the majority of patients.

Infection. In nearly all cases with pre-operative urinary infection, the infection may be cured if all calculus is removed.

Stone clearance. With perseverance a high percentage of complete clearance can be achieved.

Calculous recurrences. Throughout the period of follow-up calculous recurrence appears very low especially in cases where the stones were of infective origin. Metabolic abnormality usually dictates a higher rate of stone recurrence. A clearer differentiation should be made between patients with calculi of metabolic origin and those whose disease appears to be determined by a preceding urinary tract infection.

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