between prolonged abuse of spirits and alcoholic hyaline deposition. It is interesting that we have not noticed this in Durban. Possibly for financial reasons 'Zulu beer' remains the most popular alcoholic beverage. It is important to note that Isaacson did not associate the change in the histological picture with an alteration in the incidence of cirrhosis. Consequently, the possibility remains that cirrhotogenic factors other than alcohol may be contained within traditional beer, the most likely candidate being iron.\textsuperscript{11} Viral infection is probably as important as alcohol in the causation of cirrhosis. Unfortunately identification was not possible during the years of the study reported, but it is the subject of a prospective study. Initial results have shown that 21 of the 42 patients with cirrhosis identified so far this year have immunological markers of present or past hepatitis B virus infection (I. M. Windsor — personal communication). Finally, the high incidence of severe chronic malnutrition in our patients (about 80\% of our male patients are below the 5th percentile for triceps skinfold thickness and weight/height ratios) probably predisposes the alcoholic or infected patient towards the later development of cirrhosis.\textsuperscript{3} It remains possible that toxic dietary factors (including herbal medicines, which are widely used by our patients) may form additional predisposing factors.

We are very grateful to Professor E. B. Adams for establishing a comprehensive record system from which the data could be collected.

REFERENCES


Transurethral prostatectomy — studies with different intravesical pressures

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Summary

In an attempt to study the safety of transurethral prostatectomy in our unit, the use of a low-pressure continuous-flow water irrigation system was compared with our routine method of intermittent bladder emptying during transurethral prostatectomy in 14 patients. The products of haemolysis and parameters of haemodilution were studied, and no significant differences were noted. However, a simple suprapubic shunt provided significant surgical advantages.


Since McCarthy's resectoscope became available in 1935, transurethral prostatectomy (TUP) has become increasingly popular. In our unit we perform 200-300 prostatectomies annually, 86\% by the transurethral route. We routinely employ sterile water as an irrigant, with intermittent emptying of the bladder by removing the working element of the resectoscope.

The well-known and documented dangers of transurethral prostatectomy are thought to be the result of intravasation of irrigation fluid into the systemic circulation. These dangers are haemolysis due to increased red cell fragility in hypo-osmotic surroundings and the 'TUP syndrome' characterized by hyponatraemia and hypervolaemia. Both may occur concurrently and lead to gross fluid overload with cardiac failure, acute renal failure, haemolytic jaundice and death.

Factors incriminated in this regard are the intravesical pressure during resection, the toxicity of the irrigant, and the time required for the resection. Several workers have advised methods to lower intravesical pressure.\textsuperscript{13} Other studies have examined the movement of irrigant into the general circulation and its effect on blood tonicity and red cell integrity.\textsuperscript{4,7} The use of continuous-flow systems during resection has also been suggested and employed by several workers.

In an attempt to study the safety of TUP in our unit, we measured electrolyte changes and the products of haemolysis. We performed a pilot study comparing a continuous-flow low-pressure system of irrigation with our routine method of intermittent bladder emptying during TUP.

Patients and methods

Fourteen unselected patients were randomly allocated to two groups. The decision to proceed with TUP was made at
preliminary cystoscopy under the same anaesthetic. All the patients in the trial were found to have benign prostatic hypertrophy on histological examination of the removed tissue.

The Storz finger-action 24 CH resectoscope was used, with a Birkhauser diathermy cutting unit. Sterile water (Travenol) in 5-litre bags was used as the irrigant. The irrigation reservoir was placed at a constant height of 60 cm above the pubic symphysis.

The first group of 7 patients underwent TUP with intermittent emptying of the bladder (our routine method). The second group of 7 patients underwent TUP with a continuous-flow low-pressure system of irrigation. At the end of preliminary cystoscopy a suprapubic shunt was instituted by inserting a 4 mm Levin-type vinyl plastic stomach tube (Lapro) via a paracentesis trocar into the full bladder. The bladder was drained into a bucket through plastic tubing attached to the suprapubic shunt. The shunt was secured by skin suture and left in situ for 1 day postoperatively.

Bladder pressures were monitored continuously on a Siemens Mingograph recorder in randomly selected patients in both groups. All the operations were performed by the authors.

All patients received the same balanced electrolyte solution (Hidroliet; Baxter) during the operation. No blood was administered to any patient. The operations were performed under an even ratio of spinal and general anaesthetics. No diuretics were administered to any of the patients during or after the operation, and no patient developed any clinical signs of haemolysis or the TUP syndrome.

As parameters of fluid compartment disturbance, the serum electrolyte, creatinine and protein levels were measured. The degree of haemolysis was assessed by measuring the free serum haemoglobin and haptoglobin values and the bilirubin fractions and examining blood films for red cell crenation. Blood was drawn pre-operatively and half an hour and 24 hours postoperatively.

**Results**

1. In the patients who underwent intermittent bladder emptying, it was possible to resect an average of 0.45 g of tissue per minute. In the patients in whom continuous-flow irrigation was used, 0.8 g/min was resected.

2. Bladder pressures during the procedures are depicted on the reproductions of actual recordings (Fig. 1 a-c): (a) intermittent-emptying method - a continuous steady rise of up to 68 cm H₂O (40 mmHg); (b) continuous-flow method - pressures never exceeded 13.6 cm H₂O (10 mmHg); (c) during Ellik evacuation with the intermittent-emptying method spikes of up to 120 cm H₂O (90 mmHg) were recorded.

3. Changes in the serum sodium levels (Fig. 2) consistent with a trend to hyponatraemia were found to a greater extent in the continuous-flow group. Serum creatinine levels were constant in all blood samples from both groups, and serum potassium levels also remained constant.

4. The serum free haemoglobin value (Fig. 3) rose immediately postoperatively, levels returning to normal limits within 24 hours. In this regard no significant difference between the two methods of irrigation was noted. Haptoglobin levels were uninfluenced by pressure per se. Analysis of bilirubin fractions (Fig. 4) showed an early yet mild rise of the indirect fraction, but this returned to normal within 24 hours. No crenation of red blood cells was visible on films obtained from either group.

5. The facility of continuous flow was easily reproducible in all patients in the group in which a suprapubic shunt was instituted.

**Discussion**

From the pressure recordings it is evident that an effective low-pressure system can be instituted using the described technique.
in the prostatic fossa plays a role in the pathogenesis of TUP. Schreiner et al.\(^2\) found that a proportion of elderly men show an inappropriate antidiuretic response to fluid overload; instead of a diuresis they respond by an antidiuresis, a reaction which may be related to previous sodium depletion. This inability to lose absorbed fluid may be a factor in producing the hyponatraemia of TUP.

Our findings have failed to show a correlation between intravesical pressures and degree of hyponatraemia. In fact the continuous-flow low-pressure group had a steeper trend towards hyponatraemia than the intermittent-emptying high-pressure group.

The reason for this phenomenon may be explained by the studies of Ceccarelli and Smith\(^1\) and Schreiner\(^2\) mentioned above. Other yet unknown factors causing these rather unexpected findings may be in force. The alleged pressure limits for intravasation have also not been standardized in the literature. Further studies are obviously needed to solve these problems.

The dangers of haemolysis have been the subject of numerous studies. The conclusions have been that haemolysis is largely avoided by using an isotonic irrigating agent. Owing to the absolute rarity of the TUP syndrome or clinically significant haemolysis in our unit, we continue to use distilled water. The levels of free haemoglobin found in our study compare well with those in studies in which isotonic solutions were utilized. All levels returned to normal within 24 hours. We could not prove a significant difference between the high- and low-pressure groups. Whether pressure in the prostatic fossa plays a significant role in haemolysis remains unknown.

The continuous-flow method was found to have significant advantages:

1. More grams of tissue are resected per minute. This is in agreement with other studies. Holmquist et al.\(^8\) showed the suprapubic shunt to have a significant advantage over the Iglesias method in this regard. The greater speed of resection puts the 'borderline'-size prostatic adenoma within the surgical limits of the average urologist.

2. Excellent vision throughout resection obviated the need for re-orientation after bladder empting. Postoperative bladder irrigation, if indicated, was greatly facilitated by means of the suprapubic shunt.

**Conclusions**

The effects of intravesical pressure on absorption of sterile water during transurethral prostatectomy was studied. As regards the parameters of intravasation and haemolysis employed in this study, no significant differences between high- and low-pressure irrigation were noted. Significant surgical advantages, however, were achieved with a simple continuous-flow low-pressure system.

**REFERENCES**