COMPLICATIONS ARISING DURING TRANSURETHRAL RESECTION OF THE PROSTATE

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THE most common complications arising during transurethral resection of the prostate are, hemorrhage, perforation, and intravascular hemolysis. The anaesthetist, by observing certain signs and symptoms, is able to recognize these complications early and reverse dangerous trends. Since the diagnosis of the first two complications is relatively easy and well known, they will not be discussed in the present paper. We will deal only with the diagnosis, prevention and treatment of intravascular hemolysis.

Hemolysis during transurethral resections is dangerous firstly, because it is often followed by anemia, jaundice and prolonged morbidity. Secondly hemolysis, if not corrected, may be followed by shock. An occasional death from shock within 36 hours of the operation has occurred where blood loss alone has been insufficient to fully explain the fatal outcome of the case. Thirdly, and most important, hemolysis is one of the factors contributing to lower nephron nephrosis in the postoperative period. McLaughlin states that Emmet has estimated that 20% of the deaths following transurethral resections are due to uremia (1) the end result of fatal forms of lower nephron nephrosis by free hemoglobin in the plasma is obscure, but Yuile (2) has been able to demonstrate a synergistic action between free hemoglobin and renal ischemia with the production of severe renal damage. In transurethral resections the renal ischemia may be produced by shock, hemorrhage or previously diseased kidneys.

Hemolysis occurring during transurethral resection of the prostrate was first recognized by McLaughlin and his co-workers in 1946 (1) Both he, Creevy and Webb (3), and others (4, 5) published cases of fatal hemolytic reactions during transurethral resections in which the distal convoluted tubules were found to be obstructed with heme pigment. This picture is similar to that found in fatalities from transfusions with incompatible blood. McLaughlin postulated that the water used as the irrigating fluid entered the circulation via opened prostatic veins, and being a hypotonic solution, hemolyzed the red blood cells. Creevy had reported that Emmet and Foley had previously observed spurts of red urine emerging from the ureteric orifices during these procedures (3).

Proving that the water did indeed enter the circulation during transurethral prostatic resections was not too difficult. Landsteiner (4), by labelling the irrigating fluid with sodium salicylate, was able to show that the fluid entered the circulation. Where glucose had been used as the irrigating fluid marked rises in plasma glucose were observed.

Many fluids have been used to replace water as the irrigating fluid in order to prevent the occurrence of intravascular hemolysis. These are, glucose 4% (6), urea 0.9% (7), urea 1.8% (7), glucose 4% to which had been added 1 unit of

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insulin per gram of glucose (8), glycine 1.1% (9), mannitol 3% (10), and most recently Cytal* (11). The solution used must have certain characteristics and lack others:—it must be non-electrolytic, transparent, non-irritating, capable of being metabolized, isotonic, and lastly easy to prepare and hence cheap. Of these glycine 1.1% first suggested by Nesbitt appears to be the most suitable. Although he recognized that glycine 1.1% is at the lower limits of isotonicity, Nesbitt was unable to demonstrate any gross hemolysis in over 1000 cases (12).

Material and Methods

In our series there were 191 transurethral resections performed on 188 patients at the St. Boniface Hospital between Jan. 1st, 1952 and Dec. 31st, 1953. With the exception of one case, a short revision operation, spinal anaesthetic was exclusively used. We used between 6 and 10 mgms. of 1% pontocaine diluted with an equal volume of 10% glucose to make it hyperbaric. The optimum level of analgesia was L 1. At this level of analgesia bladder pain was obtunded without any disturbance of the patient's blood pressure At this level a few pain fibres to the bladder and pain fibres innervating the peritoneum were not affected so that dangerous overdistension of the bladder produced pain and perforations of the bladder were signalled by the early onset of pain and abdominal rigidity. Furthermore, by paralyzing the parasympathetic vasodilator fibres to the prostatic plexus and allowing unrestricted sympathetic vasoconstrictor activity, bleeding was considerably diminished (13). At the end of every operation a sample of blood was taken from a forearm vein and tested for the presence of hemolysis. If, during the operation, signs and symptoms suggestive of hemolysis appeared, then a sample of blood was withdrawn at that point, and treatment instituted before the result was obtained from the laboratory. The technique of testing for hemolysis was the essence of simplicity. The sample of blood was carefully withdrawn into a dry 10 ccs. syringe and then gently placed in a centrifuge tube and centrifuged for 30 minutes and the supernatant fluid examined for hemolysis. No quantitative examination was done. A slight pink tint was reported a slight hemolysis, a definite red tinge as hemolysis, and a dark red colour as marked hemolysis. Records were kept for every case for age, blood loss, duration of operation, preoperative condition of the patient, hemolysis, irrigating fluid used, and whether clinical signs of hemolysis were present or absent.

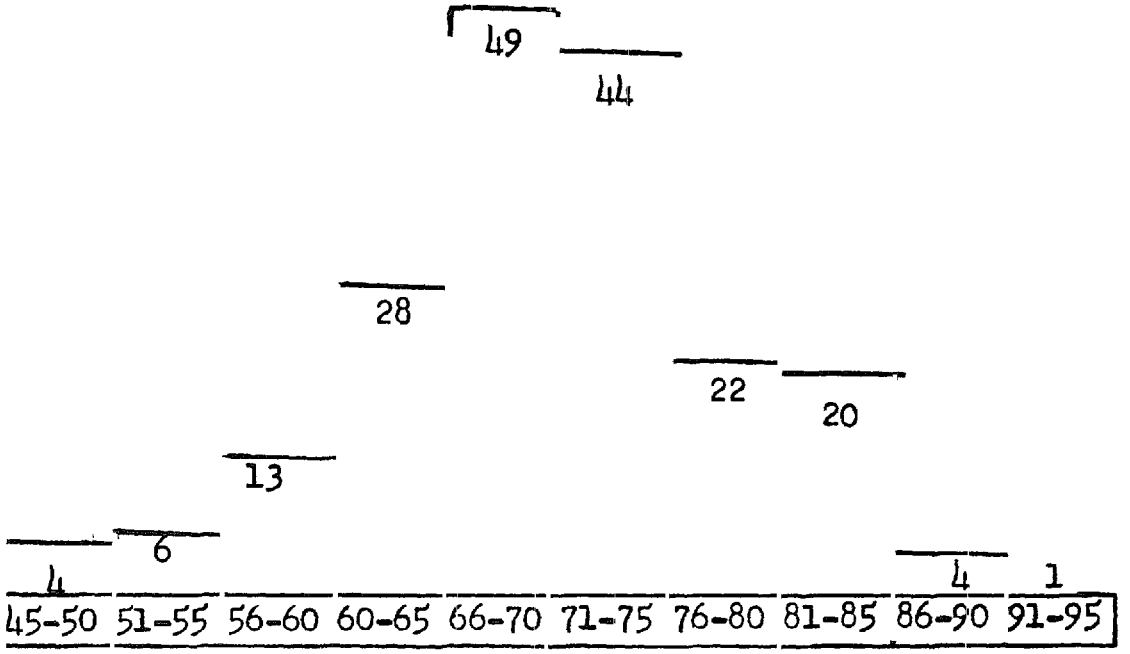
In addition, Mr. Coleman, biochemist at St. Boniface Hospital, conducted in vitro experiments on the hemolyzing properties of the following solutions:—

1. Hemolyzed fluid taken directly from the bladder during the course of an operation where water was being used as the irrigating fluid.
2. Emulsions were made of prostatic tissue removed at operation.
3. Sterile water.
4. Glycine in concentrations varying from 0.8% – 1.5%.

*Cytal is the official trade name adopted by the Cutter Laboratories of Berkeley, California for the following solution —Sorbital 2.73 gm./100 ccs., Mannitol .546 gm./100 ccs., Methylparahydroxybenzoate .0005 gm./100 ccs., Propylparahydroxybenzoate .0001 gm./100 ccs., Butylparahydroxybenzoate .0001 gm./100 ccs.

TABLE I

THE AGE DISTRIBUTION IN 191 TRANSURETHRAL RESECTIONS OF THE PROSTATE GLAND.



Average age - 70.9 years.

Median age - 71 years.

Complications

Blood loss over 600 ccs.—15 (thirteen were associated with hemolysis.)
Perforations occurred twice.
Deaths within one week of operation—5.
Mortality rate—2.61%.

The average or arithmetic mean age in our series was 70.9 years and the median was 71 years; 73.3% of the patients were over 65 years of age and 25 were over the age of 80. The youngest in the series was 46 and the oldest 93. Many of these patients (22.4%) suffered from varying degrees of cardiovascular insufficiency and emphysema. So-called "chronic bronchitis" and asthma were not uncommon preoperative findings. In spite of this, with careful preoperative preparation, and when hemorrhage, hemolysis and perforations were avoided or recognized and treated early, the operative and postoperative courses were amazingly smooth.

Blood loss of over 600 ccs. was encountered 19 times and 13 of these were associated with hemolysis, illustrating an expected finding, namely; that where large venous sinuses are opened, hemolysis is more likely to occur.

Perforations occurred on 2 occasions, in one of the cases the perforation was very small. In the other case, the operation was abandoned and a retropubic prostatectomy was carried out successfully at a later date.

With the onset of hemolysis a fairly typical picture presents itself during the resection. The patient may begin to complain of a sudden feeling of weakness and tiredness, or he may start to chill and become clammy. Not uncommonly, a tightness of the chest is the most marked feature—symptomatic of bronchospasm. At the same time, or shortly after, the blood pressure begins to rise and the pulse rate to fall. In our series hemolysis occurred a total of 57 times and in 23 cases the blood pressure rise was the prominent feature. The other symptoms occurred more infrequently. It must be emphasized that varying degrees of hemolysis can occur, as shown by the laboratory, without any clinical signs manifesting themselves.

Whenever the blood pressure was observed to rise and the pulse rate to fall, or if other signs suggestive of intravascular hemolysis manifested themselves, a sample of blood was taken and sent to the laboratory to be checked for the presence of free hemoglobin. At the same time the surgeon was notified that hemolysis was suspected and an intravenous infusion of 15% Dextrose was started. If the surgeon was using water as the irrigating fluid he would then change to glycine 1.1%. Attempts at coagulating open bleeders with high fluid pressures were not prolonged in the presence of gross hemolysis; pressure from a Foley bulb was substituted. Restlessness and apprehension often preceded the rise in blood pressure and mild sedation with minimal doses of pentothal, and Demerol in 20 mgm. doses were usually effective.

If hemolysis was definitely established by the laboratory then 750 ccs. of 15%

FIGURE 1

Date—May 28th

Age—75

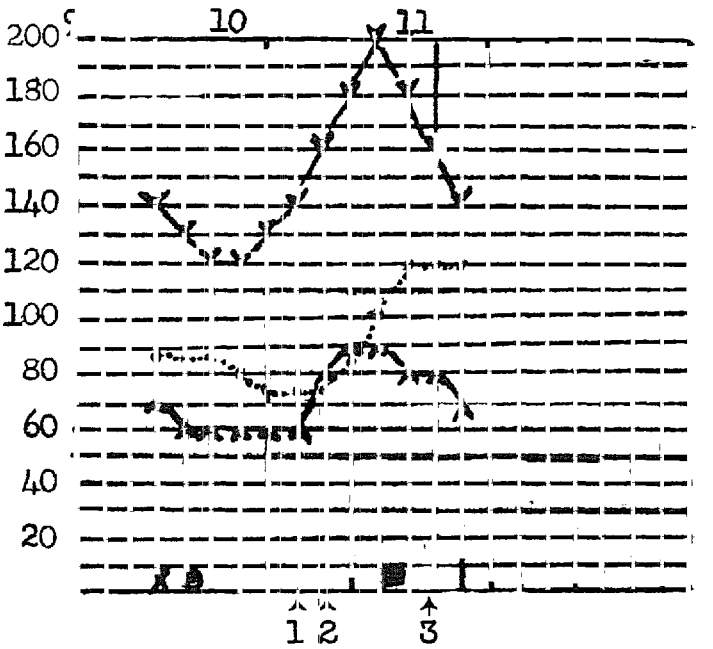
Name—Essers

Pre-op condition—Diabetes

Anaesthetic—1% Pont 9 mgm.

Blood loss—460 ccs.

Hemolysis—Marked



1 Patient complaining of neck pains and chills.
2. Glucose 15%—750 ccs. started.
3. Patient returned to the ward

Glucose was given twice daily for three post-operative days and the patient observed closely for oliguria and anuria. The use of 15% glucose was first suggested to us by Dr. Earl Stephenson and followed along the line of treatment as outlined by Thorn (14). Almost invariably when this treatment was instituted, the blood pressure rise was reversed, and the postoperative course remained smooth.

Figures 1 and 2 represent the operative courses of two of the cases in our series that exhibited signs and symptoms of intravascular hemolysis. It may be noted that in case 1 the onset of hemolysis was characterized by chills, whereas in case 2 the first sign was the rising blood pressure. Hemolysis was proven by testing samples of the patients' blood, taken at the first suggestion of hemolysis. On account of the marked hemolysis found in the first case he was given 1500 ccs. of 15% glucose for three postoperative days. The postoperative courses, except for mild and brief hypotension, were smooth.

FIGURE 2

Date—Nov 5th

Age—76

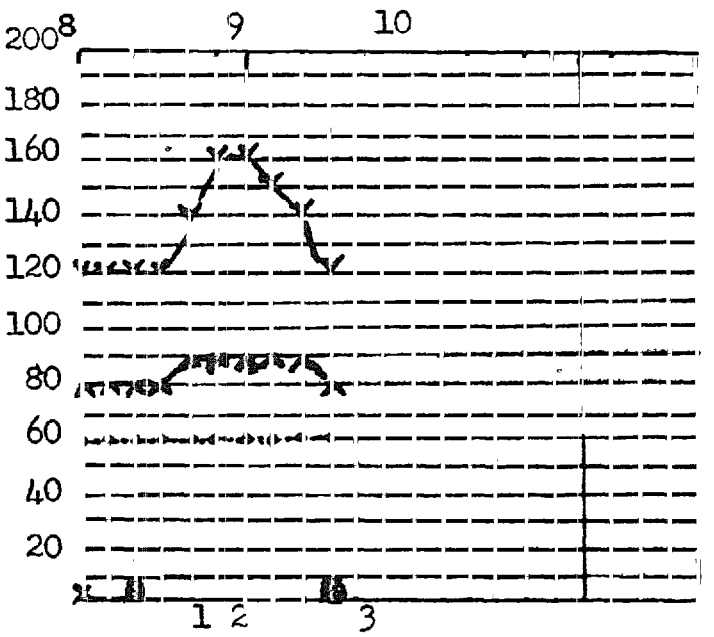
Name—Mayhew

Pre-op condition—Negative

Anaesthetic—1% Pont 9 mgm

Blood loss—902 ccs

Hemolysis—positive



1 Glucose 15% started.
2. Blood taken to test for hemolysis—positive.
3 Blood started.

To repeat—signs and symptoms were present in about 50% of the cases in which hemolysis was proven to have occurred.

One sees from Table II that neither fluid taken from the bladder during a transurethral resection, mixed with the burned products of the coagulating and cutting currents, nor emulsions of prostatic tissue removed at operation, were

TABLE II

Hemolyzing Properties of Certain Solutions		
Fluid from the bladder		None
Emulsions of Prostatic Tissue		None
Sterile water (distilled)		Marked
Glycine solutions		
	0 8%	Marked
	0 9%	Marked
	1 0%	None
	1 1%–1 5%	None

hemolytic in themselves. Sterile distilled water was, of course, markedly hemolytic, and glycine below a concentration of 1.0% but not above 1.0% was hemolytic; dilutions to 1.5% only were tested for hemolytic properties.

Conclusions and Summary

We believe that hemolysis during a transurethral resection of the prostate is one of the factors involved in the production of a lower nephron nephrosis postoperatively. The other factors are hemorrhage, shock and previously diseased kidneys. These latter three factors may be minimized by obvious means and the factor of intravascular hemolysis diminished by the use of an isotonic irrigating fluid, or if water is being used, by the early recognition and treatment of hemolysis. It is true that isotonic solutions, by virtue of their non-hemolyzing properties, do interfere somewhat with vision within the bladder, but it requires very little change in surgical technique to overcome this obstacle.

In our series hemolysis occurred a total of 57 times, and in 50% of the cases signs and symptoms suggestive of hemolysis occurred.

Signs and symptoms suggestive of hemolysis are, a sudden feeling of weakness or tiredness, chills and/or a clammy skin, bronchospasm, a rising blood pressure usually accompanied by a slowing of the pulse rate.

By following the principle of early recognition and treatment there were, in our series of 191 cases, no instance of postoperative anuria, nor was lower nephron nephrosis a feature in any of our postoperative deaths.

Résumé

L'hémolyse intravasculaire pendant l'excision transurétrale du prostate est une complication assez commune. Cette complication si elle est parfois accompagnée de choc et quelquefois d'hémolyse peut contribuer au développement

d'une néphrose du néphron inférieur. On pense que l'hémolyse pendant l'excision transurétrale se développe ainsi: le fluide employé comme agent d'irrigation est généralement l'eau. Cette eau peut entrer dans la circulation par voie d'une ouverture des veines prostatiques, et, étant hypotonique, hémolysera les cellules rouges du sang.

Dans 191 cas à l'hôpital St Boniface le sang du patient, à la fin de chaque opération, a été régulièrement examiné pour y déterminer la présence d'hémolyse. Dans tous nos cas la technique employée a été une basse anesthésie lombaire jusqu'au lombaire I. L'hémolyse observée visuellement s'est déclarée en tout 57 fois pour une incidence de 29%.

Les signes et les symptômes de l'hémolyse sont les suivants: le patient se plaint de faiblesse et/ou de fatigue, peau froide et moite, toux coqueluchoide, augmentation de la pression artérielle et ralentissement du poulx. Dans notre série les signes et les symptômes indiquant l'hémolyse se sont déclarés dans plus de 50% des cas où l'hémolyse a été confirmée par une examination visuelle du sang du patient. L'augmentation de la pression artérielle et le ralentissement du poulx ont été les symptômes constants et se sont déclarés dans 23 sur 57 cas. On a aussi noté que l'hémolyse peut être présente sans produire de signes ou symptômes.

La prévention est possible par l'emploi d'un fluide d'irrigation isotonique telle la glycine 1.1 à 1.5%, le Cytal, etc. Le traitement consiste à commencer avec 750 ccs de glucose à 15%, réduction d'essais prolongés de coagulation du sang sous pression élevée de fluide, le demerol pour l'agitation et substituer une solution isotonique comme fluide d'irrigation Envoyer un specimen du sang au laboratoire à fin de confirmation du diagnostic et si l'hémolyse est marquée poursuivre alors avec le glucose à 15% deux fois par jour pendant trois jours et tenir un compte exact de l'absorption et de l'émission urinaire des patients.

Dans notre série, lorsque le régime précité a été institué, la hausse de la pression artérielle a été renversée et les progrès après l'opération ont été suivis.

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