EVALUATION OF THE ROLE OF PERITONEAL DIALYSIS

THESIS
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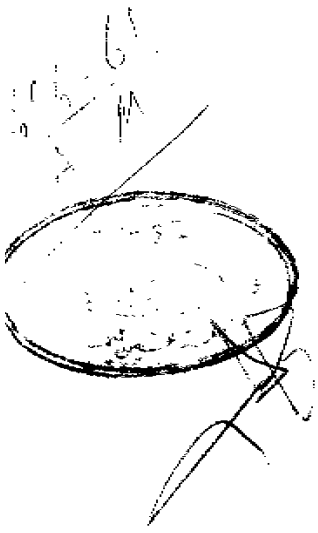

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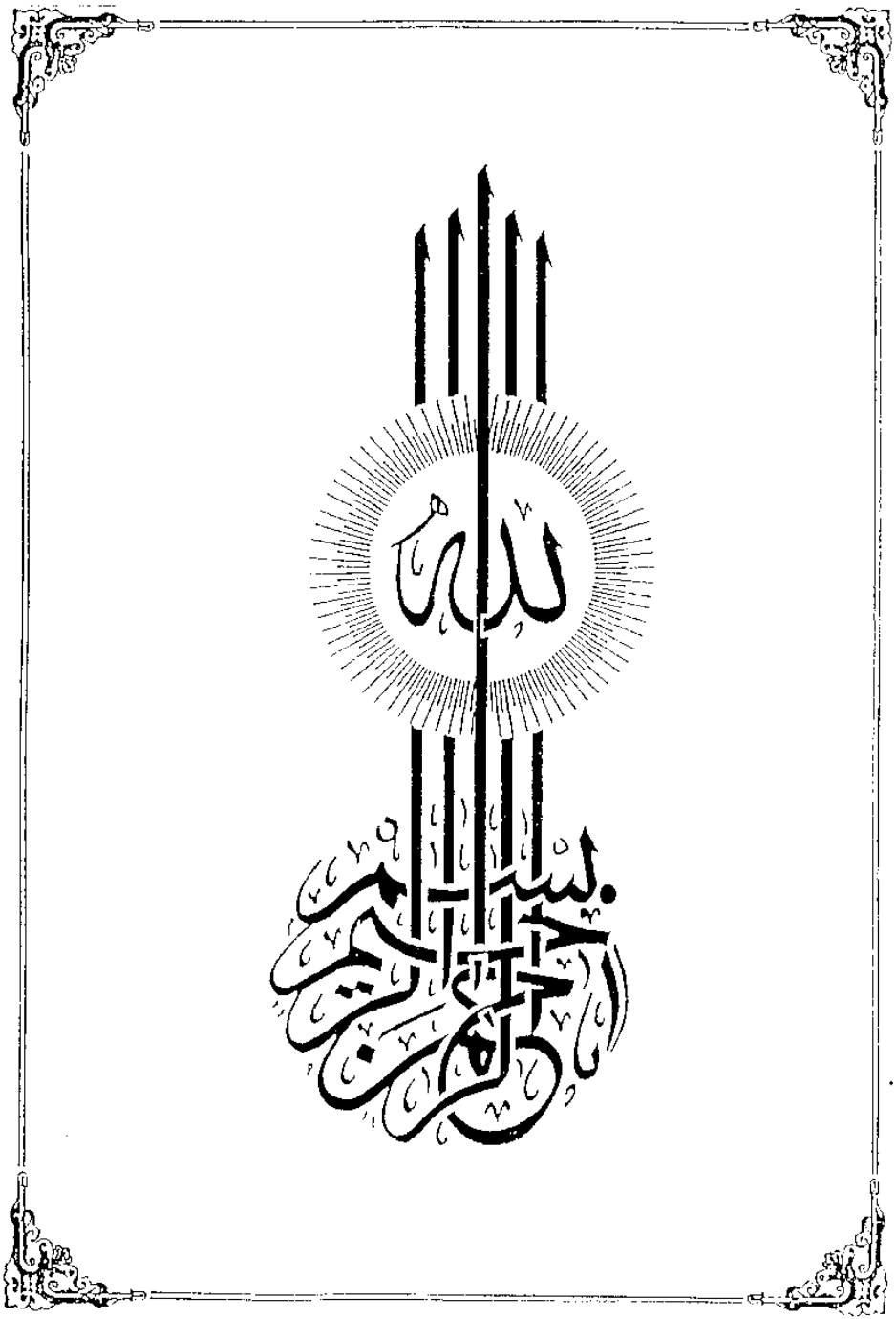

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INTRODUCTION

Most of the hospitals in Egypt do not have facilities for haemodialysis. In these hospitals, peritoneal dialysis would play an important role.

In this study, review of the indications of P.D. is done, as well as its various techniques including continuous ambulatory peritoneal dialysis, and its complications.

The practical part of this study is to evaluate P.D. in Heliopolis Hospital where the candidate works. All cases of P.D. done in this hospital over a period of 4 months will be studied. Full clinical and laboratory studies are done including blood urea, serum creatinine, serum sodium and potassium and complete blood picture. As well as description of the technique used and the indication of P.D. in each case. The possible complications will be described.

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HISTORY OF PERITONEAL DIALYSIS

Peritoneal dialysis (P.D.) was first used in the treatment of patients with renal failure by Ganter in 1923. During the next 25 years, however, the technique was not widely adopted, mainly because of a high incidence of complications such as peritoneal infections, fluid and electrolyte imbalance, and various technical difficulties.

Odel et al. (1950) revealed that only 101 patients with renal failure had been treated by P.D. during this period. The discovery of antibiotics and refinements of the technique (Maxwell et al., 1959) led to renewed interest.

The availability of commercially prepared sterile fluid and administration sets has contributed significantly towards its rapidly increasing popularity. During the past decade, P.D. has become firmly established as an efficient,safe,

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and simple method of treating renal failure (Miller & Tassistro, 1969).

P.D. has undergone three periods of evolution during its relatively short existence. The early period began in the 1920s for treatment of acute renal failure. The next period was of chronic intermittent P.D. which emerged in the 1960s. The third phase, that of continuous ambulatory peritoneal dialysis (CAPD), has evolved over the past five years.

EARLY PERIOD OF P.D. IN ACUTE RENAL FAILURE:

Initial clinical experience:

Ganter (1923) was the 1st to describe the instillation of 1.5 litres of saline solution into the peritoneal cavity of a patient to treat uraemia. By 1940, P.D. had been used both in Europe and in U.S.A. Many more reports on the use of P.D. in renal failure appeared between 1946 and 1950.

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Odel et al (1950) collected, from publications up to 1948, a total of 101 patients who had been treated by P.D. With this treatment 32 of 63 patients with acute renal failure survived.

TECHNIQUES:

The catheters used for P.D. were usually improvised and made from tubing available for other purposes. Gastric lavage rubber tubes were shortened and after making side holes were used as catheters. Metal tubing with perforations was also employed and later polythene tubing was used in the same way. Small diameter stiff plastic catheters were manufactured in 1959 and are still being used in some places. The catheters were placed in the peritoneal cavity using a trocar. Initially large bore trocars were used to accomodate the large tubing until Weston & Roberts (1965) desigend the Trocath - a small stiff

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catheter with a stylet inside the lumen which was used to penetrate the peritoneum. Fluid is infused and after a dwell time drained out, then the cycle is repeated.

DIALYSATE COMPOSITION:

Before fluids became commercially available, clinicians had to make their own dialysate Frequently, mineral and glucose solutions had to be mixed prior to dialysis, this allowed flexibility of dialysate composition to adjust to the clinical condition. More dextrose could be added when the patient was overhydrated and potassium concentrations could be lowered or increased depending on the serum level.

Initially, either normal saline or 5% glucose solution was used. In 1927, Huesser and Werder advocated the use of saline with the addition of 2% to 5% glucose to make a

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hypertonic dialysate. Roads (1938) added lactate to the fluid as a source of bicarbonate. Bicarbonate itself was a part of Ringer's solution (2.4 mEq/L) and Tyrod's solution (12 mEq/L) which had also been used as dialysate.

Abbot & Shea's (1946) peritoneal dialysate contained 26 mEq bicarbonate/L., Odel et al (1950); 24 to 36 mEq/L, Grollman's; 35.8 mEq/L (Beon, 1961).

Commercial solutions which became available around 1959, contained lactate in a concentration of 35 to 44 mEq/L. Sodium concentration in the solution varied from 130 to 140 mEq/L, potassium from 0 to 5 mEq/L., calcium from 2 to 4 mEq/L. and magnesium from 0 to 2 mEq/L.

The availability of commercial fluid encouraged the widespread use of P.D. (Miller et al 1979).

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CLINICAL RESULTS OF THE EARLY PERIOD OF P.D.:

It was mentioned in the earlier publications that improvement in blood chemistry was not seen. This was due to inefficiency in peritoneal clearance of the substances measured.

Furthermore, although dialysis duration was sometimes long, the amount of fluid used was too small to produce significant removal of waste products. The difference in outcome lead Hamburger & Richet (1956) to state that only haemo-dialysis could correct the abnormalities in calcium, chloride and phosphate levels.

Boen (1977) however, demonstrated that improvement in blood chemistry was achieved provided a large amount of dialysate was used and the dialysis was prolonged. The clearance obtained with P.D. is far lower than the H.D. clearance. The peritoneal urea clearance

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averages 12 mL/min when 1 L. of dialysate is cycled per hour, 20 mL/min. with 2 L. per hour, 25 mL/min with 3 L. per hour and around 30 mL/min with 4 L. per hour. There is clearly a relationship between flow rate and clearance values.

Tenckhoff et al (1965) showed a further increase of the urea clearance up to 40 mL/min at a dialysate flow-rate of 10 L. per hour.

Bomar et al (1974) obtained close agreement with this data in their mathematical models.

The diffusion curves of creatinine, uric acid and phosphate are lower than urea. Accordingly, the peritoneal clearances of these substances are lower than the urea clearances. This is similar to H.D. membrane clearance characteristics. However, the peritoneal membrane apparently have some areas

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with large pore sizes. All fractions of serum proteins were found in the dialysate outflow, (Boen, 1961).

Scarpioni et al (1978) demonstrated the inverse relationship between the molecular weight of plasma proteins and their peritoneal clearances.

THE PERIOD OF CHRONIC INTERMITTENT P.D.:

Boen (1962) was the 1st who tried P.D. in patients with end stage renal failure, Devices for repeated access into the peritoneal cavity were made. These were tubes of teflon or silicone rubber which were implanted in the abdominal wall for the insertion of catheters. After dialysis the catheter was removed and the tubes closed by a cap.

Merrill et al (1962) also tried this approach. All such approaches failed because of peritonitis and the formation of adhesions

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which blocked the catheter pathway. So, for long term success of chronic P.D. it was essential to eliminate peritonitis. One cause of peritonitis was contamination of the dialysate during the changes of dialysate bottles. To avoid this, Boen et al (1962) produced dialysate in 40 L. bottles and used a closed sterile system during the entire 10 hour dialysis. An automatic P.D. machine was constructed in 1962. Its other aim was to minimize attendance by a nurse for clamping and opening fluid-lines. From the 40 L. bottles the fluid was pumped into the patient. The outflow fluid was collected in a sterile 40 L. bottle. Timers control the inflow time, dwell time and outflow time.

In 1963 access devices were abandoned and the repeated puncture technique was used (Boen et al., 1964).

For each dialysis a small bore stiff

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catheter was used, inserted through a specially made small trocar. In late 1964, the Trocath began to be used. The catheter was removed after each dialysis.

The pre-dialysis BUN concentrations varied between 100 and 150 mg %, the serum creatinine levels around 15 mg % and uric acid concentrations 9 mg %. The post-dialysis values were BUN usually around 50 mg %, serum creatinine about 9 mg % and uric acid 5 mg%. The blood pressure was well controlled without antihypertensive medications. The protein loss was about 30 and 50 g per dialysis and the serum albumin levels were in the low normal range. The peritoneal urea-clearance remained the same over a 2-years period (Tenckhoff and Boen, 1965).

Although the repeated puncture technique is feasible, it can not be used on a large scale because of the time invovled for the physician.

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